USAF SERIES A-37B AIRCRAFT

F33657-67-C-0824
F33657-71-C-0018

FLIGHT MANUAL

CHANGE NOTICE

LATEST CHANGED PAGES SUPERSEDE THE SAME PAGES OF PREVIOUS DATE

Insert changed pages into basic publication. Destroy superseded pages.

THIS CHANGE INCORPORATES SAFETY AND OPERATIONAL SUPPLEMENTS SS-8, S-32, AND S-34. REFER TO BASIC INDEX T.O. 0-1-1-5 AND SUPPLEMENTS THERETO, FOR CURRENT STATUS OF FLIGHT MANUALS, SAFETY/OPERATIONAL SUPPLEMENTS, AND FLIGHT CREW CHECKLISTS.

Commanders Are Responsible for Bringing this Publication to the Attention of all Affected Personnel.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

AIR FORCE - 8 December 1971 - 1400

1 MAY 1968

Change 10 1 September 1971

Technical orders are normally distributed promptly after printing. Date(s) shown on the title page (lower right corner) are for identification only. This is not a distribution date. Processing time sometimes causes distribution to only appear to have been delayed.

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES

LIST OF EFFECTIVE PAGES

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue for original and changed pages are:

Original	0	1 May 68
Change	1	1 Sep 68
Change	2	1 Dec 68
Change	3	1 Feb 69
Change	4	1 Jun 69
Change	5	1 Sep 69
Change	6	1 Dec 69
Change	7	1 Mar 70
Change	8	1 Jun 70
Change	9	1 Apr 71
Change	10	1 Sep 71

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 262, CONSISTING OF THE FOLLOWING:

Page No.	Change No.
*Title	10
*A - B	10
C Blank	3
i	0
*ii	10
iii	9
iv Blank	0
*v	10
vi Blank	0
*vii	10
*viii Blank	10
*ix Deleted	10
*x Blank Deleted	10
1-1 - 1-4	9
1-5	7
*1-6	10
1-7 - 1-8	9
1-8A	9
1-8B Blank	1
1-9	2
1-10	0
1-11	8
1-12	3
1-13 - 1-14	9
1-14A	9
1-14B Blank	3
*1-15-16	10
1-17 - 1-18	9
*1-19	10
1-20 - 1-22	9
1-23	8
1-24 - 1-25	9
*1-26	10
1-27	9
*1-28	10
*1-28A	10
1-28B	9
1-29 - 1-30	4
1-31	6
1-32	8
1-32A	9
1-32B Blank	7
1-33 - 1-34	7
*1-34A - 1-34C	10
1-34D Blank	7
*1-35	10
1-36	9
1-37	2
1-38	9
*1-39 - 1-40	10
1-41	9
*1-42	10
*1-42A - 1-42B	10
1-42C - 1-42D	6
1-43	5
1-44 - 1-46	9
1-46A - 1-46B	9
1-47	2
1-48	6
1-49	4
1-50	5
*1-51	10
1-52	2
1-53	0
1-54	8

CURRENT FLIGHT CREW CHECKLIST

T. O. 1A-37B-1CL-1
1 MAY 1968

Change 9 - 1 September 1971

Upon receipt of the second and subsequent changes to this technical order, personnel responsible for maintaining this publication in current status will ascertain that all previous changes have been received and incorporated. Action should be taken promptly if the publication is incomplete.

* The asterisk indicates pages changed, added or deleted by the current change

ADDITIONAL COPIES OF THIS PUBLICATION MAY BE OBTAINED BY USAF ACTIVITIES IN ACCORDANCE WITH T.O. 00-5-2.

A-10

LIST OF EFFECTIVE PAGES

Page No.	Change No.
1-55 - 1-56	2
1-57	0
1-58	5
1-59	0
*1-60 - 1-64	10
*1-64A Added	10
*1-64B Blank Added	10
*1-65	10
1-66 - 1-68	2
2-1	9
2-2	0
2-3 - 2-7	9
*2-8	10
2-9 - 2-10	9
*2-11 - 2-15	10
2-16	9
3-1 - 3-3	9
3-4	5
3-5	0
3-6 - 3-8	9
*3-9 - 3-10	10
3-11 - 3-16	9
4-1	0
4-2 Blank	0
5-1	8
*5-2	10
5-3	4
5-4 - 5-6	9
5-6A - 5-6B	9
5-7	9
*5-8 - 5-10	10
6-1 - 6-2	8
6-3 - 6-4	9
6-5	2
6-6	4
6-7 - 6-10	0
6-11 - 6-12	4
6-12A	4
6-12B Blank	4
7-1	2
7-2 - 7-4	9
*7-5 - 7-6	10
7-7 - 7-8	1
A1-1 - A1-2	9
A1-3	0
A1-4 - A1-8	9
A1-9	5
*A1-10	10
A2-1 - A2-21	9
A2-22 Blank	0
A3-1 - A3-9	9
A3-10 Blank	0
A4-1 - A4-8	9
A4-8A - A4-8B	9
A4-9 - A4-26	9
A5-1 - A5-6	9
A6-1 - A6-2	9
A7-1 - A7-2	9
*A8-1 - A8-2	10
A8-3	9
*A8-4	10
*A8-4A Added	10
*A8-4B Added	10
A8-5	9
A8-6 Blank	0
*Index 1 - Index 2	10
Index 3 - Index 4	9
*Index 5 - Index 8	10

table of contents

DON'T GAMBLE WITH YOUR LIFE

SCOPE

This manual contains information which will provide you with a general knowledge of the aircraft, its characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized; therefore, basic flight principals are avoided. Multiple emergencies, adverse weather, terrain, or extenuating circumstances may require modification of any procedure(s) presented in this manual.

PERMISSIBLE OPERATIONS

The flight manual takes a "positive approach" and normally states only what you can do. Unusual operations or configurations which exceed the limitations as specified in this manual must be approved by the Flight Manual Manager ASD (SDQS). Clearance must be obtained from the major command before any questionable operation is attempted which is not specifically permitted in this manual.

HOW TO BE ASSURED OF HAVING LATEST DATA

You must remain constantly aware of the latest manual, checklists and status of supplements. T. O. 0-1-1-5 (supplemented monthly) and the latest flight manual or supplement flyleaf provide a listing of the current flight manuals, checklists and supplements.

STANDARDIZATION AND ARRANGEMENT

Standardization assures that the scope and arrangement of all Flight Manuals are identical. The manual is divided into 8 fairly independent sections to simplify reading it straight through or using it as a reference manual.

SAFETY AND OPERATIONAL SUPPLEMENTS

Safety supplements are issued as an expeditious means of reflecting safety information when hazardous or safety conditions exist. These supplements contain operational, precautionary and restrictive instructions that affect safety and safety modifications. Operational supplements are issued as an expeditious means of reflecting information when mission essential operational procedures are involved. Supplements are issued by teletype (interim) or by printed copy (formal) depending upon the urgency. Interim supplements are formalized and replaced with a new number within 30 days. If checklist pages are affected the interim supplement will be replaced within 10 days. Formal printed supplements are identified by red letters "SS" for safety supplements and black letters "OS" for operational supplements printed around the borders of the title pages. All supplements use the same numbering system; however, a safety supplement can also be identified by the "SS" preceding the number. Operational supplement numbers are preceded by a single "S." Current supplements must be complied with. A Safety and Operational Supplement Status page is furnished with each formal Safety and Operational supplement as well as this manual in order to help you be constantly aware of the status of all supplements. Since these status pages can only be as current as the associated publications, it is also necessary to refer to the appropriate index, T. O. 0-1-1-5. The title block of each supplement and title page of this manual will show the effect they have on supplements. As a further aid, a supplement summary is included in this manual following the A pages to show the disposition of each supplement incorporated in the manual as well as the replacement and rescission actions affecting those supplements. File your supplements in reverse numerical and chronological order in front of the manual; i. e., the latest supplement on top, regardless of whether it is a safety or operational supplement.

CHECKLISTS

The flight manual contains amplified normal and emergency procedures. Checklists containing abbreviated or condensed procedures have been issued as separate technical orders. See the "A" page of this manual and the latest supplement flyleaf for current applicable checklists. Line items in the flight manual and checklists are identical with respect to arrangement and item number. If authorized by an interim safety or operational supplement that affects a checklist, write in the applicable change on the affected checklist. Within 10 days, a formal supplement will be issued with the revised checklist page attached.

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to "Warnings," "Cautions," and "Notes" found throughout the manual.

WARNING

Operating procedures, techniques, etc., which will result in personal injury or loss of life if not carefully followed.

CAUTION

Operating procedures, techniques, etc., which result in damage to equipment if not carefully followed.

Note

An operating procedure, technique, etc., which is considered essential to emphasize.

YOUR RESPONSIBILITY - TO LET US KNOW

Every effort is made to keep the Flight Manual current. Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. However, we cannot correct an error unless we know of its existence. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this manual or any phase of the Flight Manual program are welcomed. These should be forwarded on AF Form 847 through your Aircrew Standardization/Evaluation Channels to HQ. Attention: (SDQS), Wright-Patterson AFB, Ohio 45433. Information copy, forward to HQ. SAAMA, Attention: (MMEAF), Kelly AFB, Texas 78241.

CHANGE SYMBOLS

Changes to text and tables in the manual are indicated by a vertical black line in the margin which extends along the entire length of the area affected. Changes to illustrations, Charts and Tables are indicated by minature pointing hands. Change Symbols are not shown for:

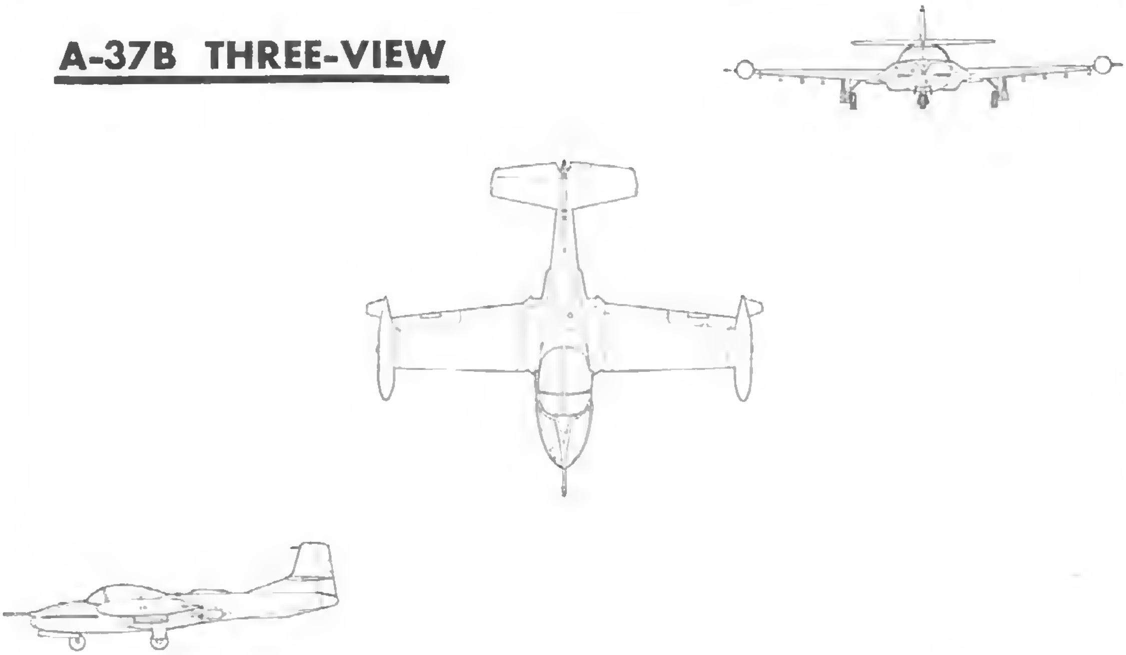
1. Introductory material, indexes and tabular data.
2. Blank spaces which are the result of text, illustration or table deletion.
3. Correction of minor inaccuracies, such as spelling, punctuation, relocation of material, etc., unless such a correction changes the meaning of instructive information and procedures.

TIME COMPLIANCE TECHNICAL ORDER STATUS

The following is a list of TCTO's that are applicable to the operation of the A-37B aircraft, and have been incorporated into the manual. This list contains only those TCTO's that are currently active.

NUMBER	TITLE	SERIAL EFFECTIVITY
T. O. 1A-37B-505	Repl of Upholstery with Flak Padding, A-37B Aircraft	67-14776 thru 67-14785
T. O. 1A-37B-506	Addition of Mode C and Mode 4 Capability to AN APX-72 IFF System, A-37B Aircraft	68-7911, 68-7912, 68-7927 thru 68-7948, 68-7950 thru 68-7974, 68-10811 thru 68-10814, 68-10819 thru 68-10827, 69-6363 thru 69-6371 and 69-6378 thru 69-6399
T. O. 1A-37B-524	Installation of Oxygen Hose Restraining Strap, A-37B Aircraft	67-14776 thru 69-6387
T. O. 1A-37B-530	Installation of Redesigned Wing, A-37B Aircraft	67-14776 thru 68-10820
T. O. 1A-37B-538	Removal of AN/APX-72 (IFF System) and Installation of AN/APX-64 (IFF System), A-37B Aircraft	68-7975, 68-7979, 68-7980, 68-10779 thru 68-10781, 68-10783 thru 68-10805, 68-10807 thru 68-10810, 69-6334 thru 69-6338, 69-6362 and 69-6377
T. O. 1A-37B-542	Removal of AN/ARC-51 System, Installation of AN/ARC-109 System, A-37B Aircraft	68-7911, 68-7912, 69-7927 thru 68-7937, 68-7944 thru 68-7947, 68-7950 thru 68-7952 and 68-7965 thru 68-7973
T. O. 1A-37B-548	Aerial Refueling Probe Extension - A-37B Aircraft	67-14776 thru 70-1291
T. O. 1A-37B-552	Modification of Armament Control System - A-37B Aircraft	67-14776 thru 70-1310
T. O. 1A-37B-554	Elimination of Oxygen Hose Restraint- A-37B Aircraft	67-14776 thru 70-1291
T. O. 1A-37B-555	Modification to Increase Gear Extension Speed - A-37B Aircraft	67-14776 thru 70-1312

A-37B THREE-VIEW



SECTION I

DESCRIPTION AND OPERATION

TABLE OF CONTENTS

THE AIRCRAFT

The A-37B is a low wing dual control jet attack, counterinsurgency aircraft, of all metal construction and side by side seating, manufactured by Cessna Aircraft Company. Power for the aircraft is provided by two General Electric turbojet engines. The aircraft is equipped with a two position speed brake, spoilers for artificial stall warning, thrust attenuators to provide a satisfactory approach angle for landing, a jettisonable clamshell canopy and ejection seats. Conventional tricycle landing gear is utilized for takeoff and landing. Other noteworthy features include 90 U.S. gallon fuel tanks at each wing tip, 4 armament pylons under each wing (modified MA4A bomb racks) which will accomodate pylon tanks, bombs, rockets, and armament pods. The aircraft contains an air conditioning and defrosting system, oxygen equipment, provisions for a nose mounted 7.62MM minigun, and full instrumentation and lighting for day or night flying. The aircraft is designed for utility, ruggedness, and safety. On aircraft ▲1, flak padding has been installed in lieu of upholstery.

▲1 AIRCRAFT 67-14786 AND ON AND AIRCRAFT 67-14776 THRU 67-14785 WHEN MODIFIED PER T.O. 1A-37B-505.

DIMENSIONS

The overall dimensions of the aircraft under normal conditions of gross weight, tire and gear inflation are as follows:

Wing Span with Tip Tank	38.34 ft.
Length with AR Boom	31.83 ft.
Length without AR Boom	29.28 ft.
Height	9.47 ft.
Wheel Base	7.83 ft.
Wheel Tread	13.66 ft.

Refer to Section II for minimum turning radius and ground clearances.

TYPICAL WEIGHTS

The typical weight of aircraft ▲8 is 6492 pounds; the typical weight of aircraft ▲9 is 6591 pounds; the typical weight of aircraft ▲10 is 6716 pounds. These typical weights (which include eight pylons, internal unusable fuel, tip tank unusable fuel and nose gun) are based on the following:

Empty Weight of Aircraft ▲8	6155 lbs.
Empty Weight of Aircraft ▲9 and ▲10	6254 lbs.
Fully Serviced Oil Systems	15 lbs.
One Pilot in Aircraft ▲8 and ▲9	200 lbs.
One Pilot in Aircraft ▲10	300 lbs.
Nose Gun Ammunition or Ballast	78 lbs.
Tailcone Ballast in Aircraft ▲10	25 lbs.
Aerial Refueling Probe Assembly	44 lbs.

The design gross weight is 14,000 pounds. Refer to Section V for additional information.

ENGINES

Thrust is supplied by two General Electric J85-17A engines. Approximate standard sea level maximum thrust rating for the engines is 2850 pounds each. The J85-17A engine is an axial flow turbojet engine. Air enters through the variable inlet guide vanes, which direct the flow of air into the eight-stage axial flow compressor, driven by a two-stage turbine on a common rotor shaft. The automatic positioning of the inlet guide vanes and bleed air valves assists in regulating compressor airflow to maintain compressor stall free operation. Air drawn into the compressor rotors, is compressed and forced into the combustion chamber where it is mixed with injected fuel and burned. The hot gases are directed upon the turbine rotor which speeds up the

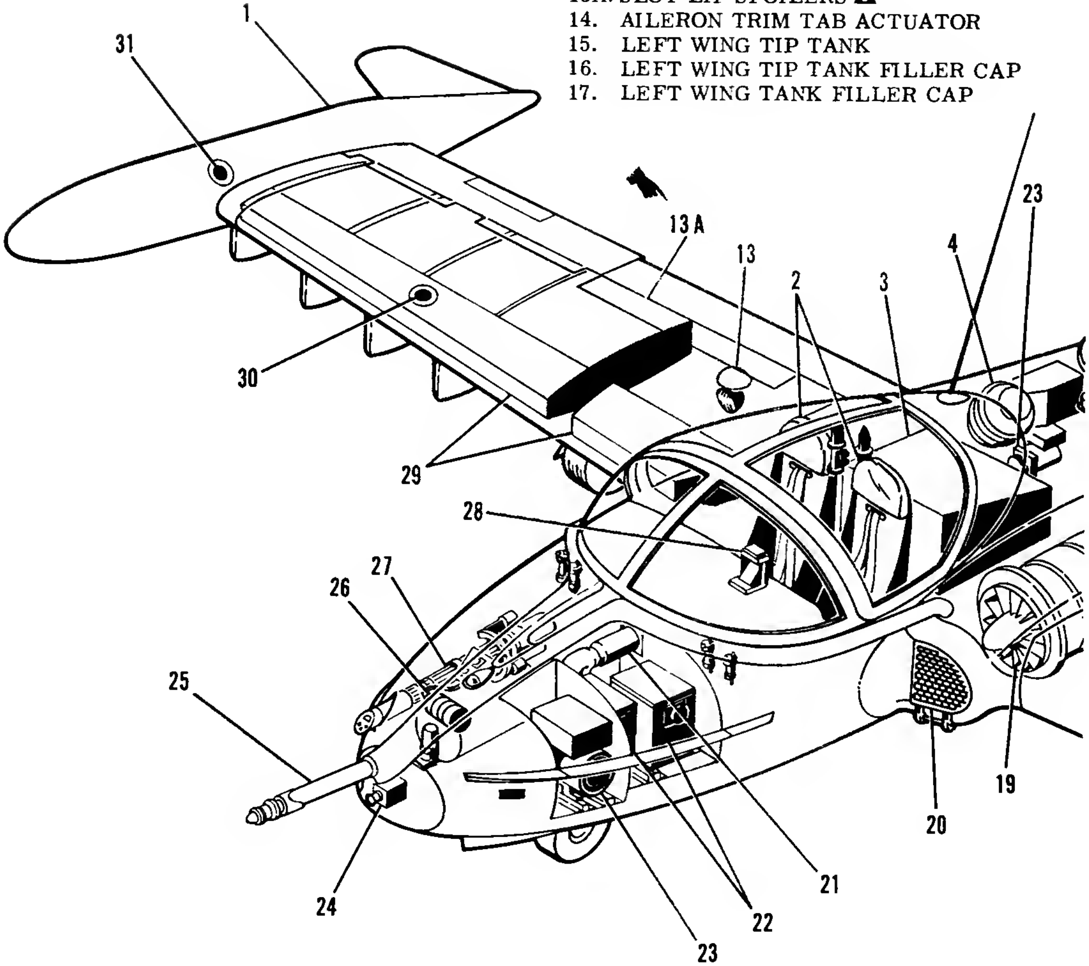
▲8 AIRCRAFT 67-14776 THRU 68-10820.
▲9 AIRCRAFT 68-10821 AND ON AND AIRCRAFT 67-14776 THRU 68-10820 WHEN MODIFIED PER T. O. 1A-37B-530.
▲10 AIRCRAFT 70-1279 AND ON.

GENERAL

1. RIGHT WING TIP TANK
2. EJECTION SEATS
3. FUSELAGE FUEL TANK
4. HYDRAULIC RESERVOIR
5. MAGNETIC DETECTOR
6. PITOT TUBE
7. RUDDER TRIM TAB ACTUATOR
8. ELEVATOR TRIM TAB ACTUATOR
9. OXYGEN CYLINDERS
10. LEFT THRUST ATTENUATOR
11. RADIO EQUIPMENT
12. OIL FILLER AND TANK
13. LANDING LIGHT

13A. SLOT LIP SPOILERS

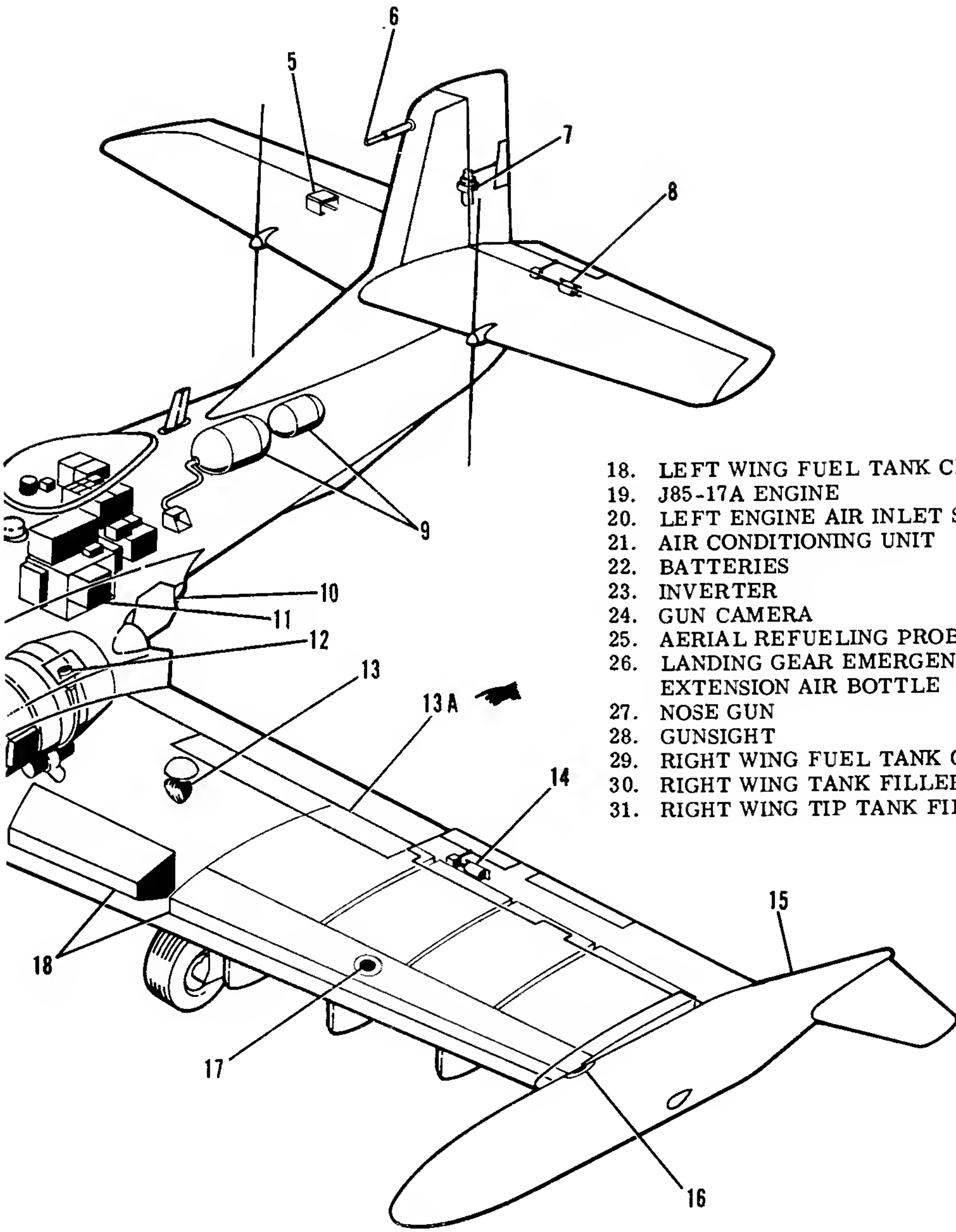
14. AILERON TRIM TAB ACTUATOR
15. LEFT WING TIP TANK
16. LEFT WING TIP TANK FILLER CAP
17. LEFT WING TANK FILLER CAP



AIRCRAFT 68-7975 AND ON AND AIRCRAFT 67-14776 THRU 68-7974 WHEN MODIFIED PER T. O. 1A-37B-530.

Figure 1-1 (Sheet 1 of 2)

ARRANGEMENT



18. LEFT WING FUEL TANK CELLS
19. J85-17A ENGINE
20. LEFT ENGINE AIR INLET SCREEN
21. AIR CONDITIONING UNIT
22. BATTERIES
23. INVERTER
24. GUN CAMERA
25. AERIAL REFUELING PROBE (IF INSTALLED) [9]
26. LANDING GEAR EMERGENCY EXTENSION AIR BOTTLE
27. NOSE GUN
28. GUNSIGHT
29. RIGHT WING FUEL TANK CELLS
30. RIGHT WING TANK FILLER CAP
31. RIGHT WING TIP TANK FILLER CAP

[9] AIRCRAFT 67-14776 AND ON EXCEPT WHEN CONSIGNED TO VNAF.

Figure 1-1 (Sheet 2 of 2)

compressor-turbine shaft to draw in and compress additional air. The hot gases of combustion pass through the exhaust diffuser and expand in the aircraft's tailpipe to produce thrust. The engines accessory section, driven by the compressor-turbine shaft, provides reduction gearing and mounting pads for all engine-driven accessories.

Note

Flight idle must be set by manual throttle control.

ENGINE FUEL CONTROL SYSTEM

Fuel flow requirements are established by the pilot's or copilot's throttle movements, and fuel flow to the engine is regulated by the engine fuel control system (figure 1-7). The fuel control system is designed to provide the engine with the proper amount of fuel for operation in all attitudes of flight within the flight envelope. Changes in engine speed, inlet temperatures (T-2), and pressure, compressor discharge pressurized engine throttle position are compensated for automatically. Fuel is not only used for combustion but also for automatic operation of the engine variable geometry, to lubricate and operate servos in the main fuel control and overspeed governor, and as a coolant for engine lube oil. The major components of the main fuel system include the main fuel pump, the main fuel control, the overspeed governor, the oil cooler, the fuel pressurizing valve, two fuel manifolds, twelve flow divider-fuel nozzles, the manifold drain valve and two hydraulic varible geometry actuators.

THROTTLES

Four throttles (3, 4, 9, 10, figure 1-5) are provided, two on each quadrant. Each quadrant is marked CUT-OFF, IDLE, and 100%. The two sets of throttles are mechanically interconnected. Throttle movement, through the use of teleflex cables, mechanically actuates each engine fuel control unit. Lift type idle detents are included on the pilot's quadrant to prevent inadvertent positioning of either set of throttles from the IDLE to CUT-OFF position. The idle detents affect both sets of throttles. It is advisable to use pilot's throttles for all engine starts in order to have the cut-off feature available. It is necessary to lift the pilot's throttles past the idle detent if engine shutdown is to be made.

CAUTION

Both engines may be shut down inadvertently by exerting excessive force on right throttles when throttles are retarded to the idle position.

Throttle Friction Knob

A throttle friction knob (13, figure 1-5) provides a means of increasing throttle friction. The friction knob can be overcome and will not prevent either crew member from manually positioning the throttles to a new setting.

INLET SCREENS

Retractable engine inlet screens are over both engine inlets. The screens, when down, are stowed under the lower front edge of the nacelles. When up, the screens will rotate around the lower tips of the inlet and cover the inlet. The inlet screens are hydraulically actuated and electrically controlled. The screens prevent ingestion of foreign objects on the ground and in flight. The screen up light on the annunciator panel will illuminate when the screens are in place over the engine inlets.

Inlet Screens Switch

The screens are controlled by a three-position, UP, DOWN and AUTO, switch (6, figure 1-6). In the AUTO position, the screen is in place when the aircraft is on the ground. The screens automatically retract on takeoff when the right main gear extends on liftoff. The main gear squat switch controls the screens in the AUTO position. In the manually selected UP or DOWN position, the screens will remain in the position indicated at all airspeeds. Power for the warning light and the inlet screens switch is supplied by the 28 volt dc bus.

WARNING

The maximum screen cycle speed is 300 KIAS.

CAUTION

The inlet screens are intended to be used only during ground operations, including taxi and takeoff and in flight during weapons delivery passes where the aircraft may encounter airborne debris generated by the ordnance.

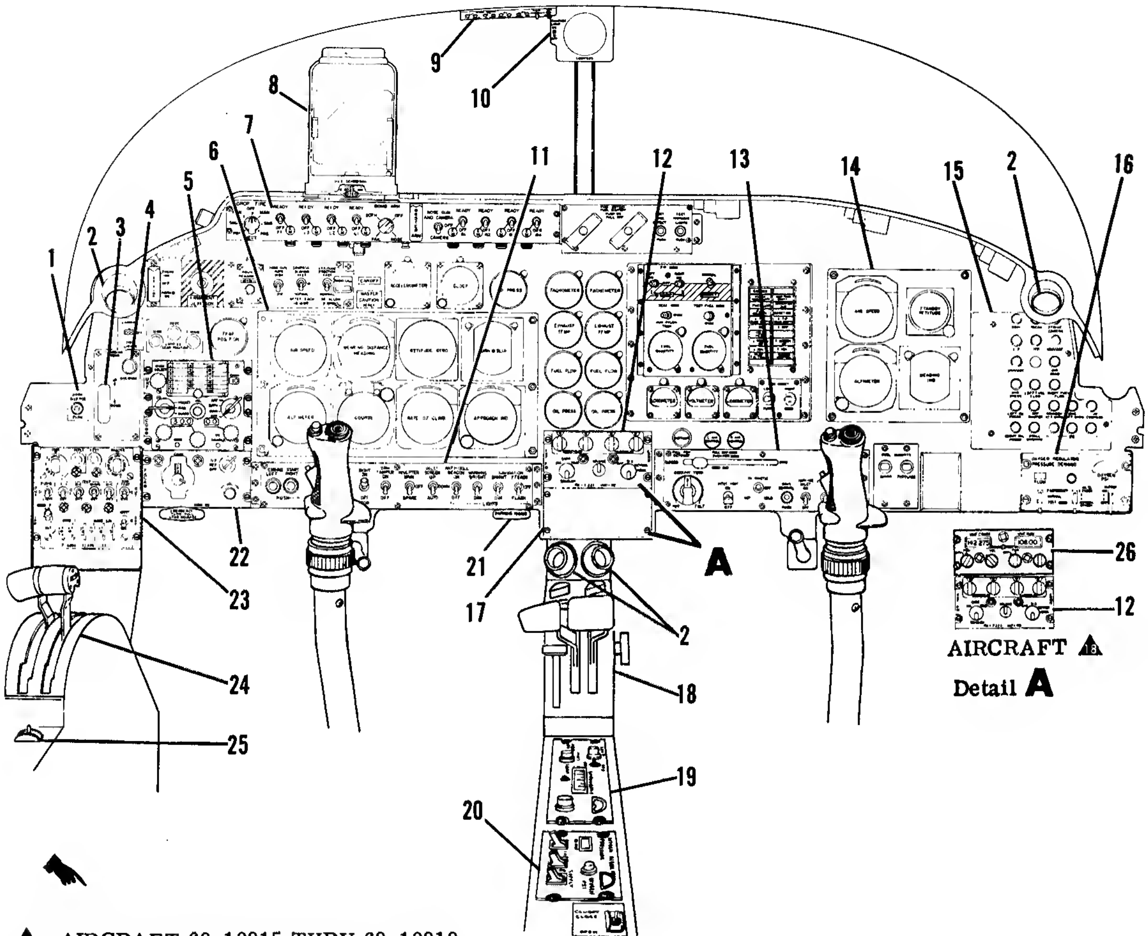
ENGINE ICE WARNING SYSTEM

The engine ice warning system warns the pilot of icing in the engine air inlet ducts. The engine ice warning light on the annunciator panel (11, figure 1-14), is amber in color and is illuminated once ice has formed on the ice detect probe which is located in the left engine air inlet duct. An automatic heating element comes on after a brief icing period. When existing ice has melted off the ice detect probe (approximately 5 seconds), the warning light will go out. The cycle will repeat itself each time ice forms on the probe. Power for the warning light and ice detect probe is received from the 28 volt dc bus.

WARNING

In the presence of visible moisture with temperature near freezing, place screens down. Ice buildup on the screens is very rapid and can cause compressor stalls.

TYPICAL COCKPIT FORWARD VIEW

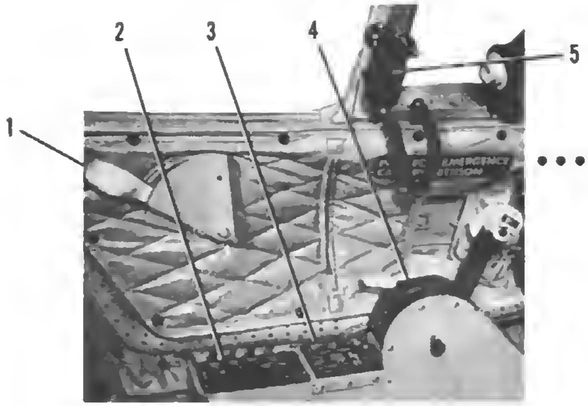


AIRCRAFT 68-10815 THRU 68-10818, 69-6372 THRU 69-6376 AND 69-6428 THRU 69-6436

1. LANDING GEAR HORN SILENCER BUTTON
2. AIR OUTLET
3. LANDING GEAR LEVER
4. LANDING GEAR OVERRIDE SWITCH
5. UHF RADIO
6. LEFT INSTRUMENT PANEL
7. ARMAMENT PANEL
8. GUNSIGHT
9. AERIAL REFUELING PANEL
10. MAGNETIC COMPASS AND LIGHT SWITCH
11. SWITCH PANEL
12. VHF/FM COMM/NAV RADIO
13. AIR CONDITIONING PANEL
14. RIGHT INSTRUMENT PANEL
15. FUSE PANEL
16. OXYGEN REGULATOR (COPILOT)
17. COVER PLATE (PROVISION FOR KY-28 SECURE VOICE)
18. COPILOTS CONTROL QUADRANT
19. LF/ADF RADIO
20. OXYGEN REGULATOR (PILOT)
21. PARKING BRAKE HANDLE
22. TACAN
23. IFF
24. PILOTS CONTROL QUADRANT
25. RUDDER TRIM SWITCH
26. VHF COMM/VHF NAV RADIO

Figure 1-2

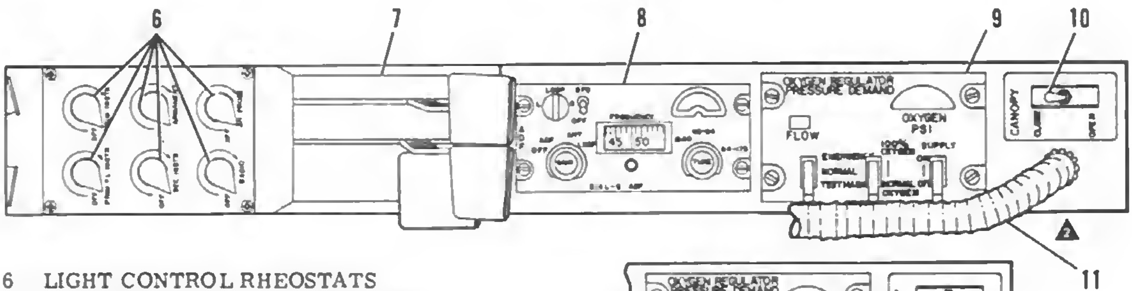
COCKPIT



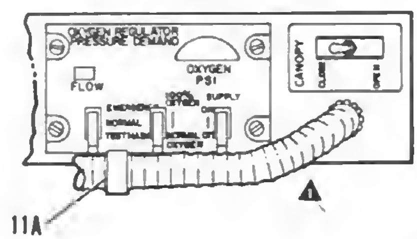
Left Side

1. CANOPY DOWNLOCK HANDLE
2. INTERPHONE CONTROL PANEL
3. ANTENNA SELECT PANEL
4. PILOTS CONTROL QUADRANT
5. COCKPIT LIGHT

Center

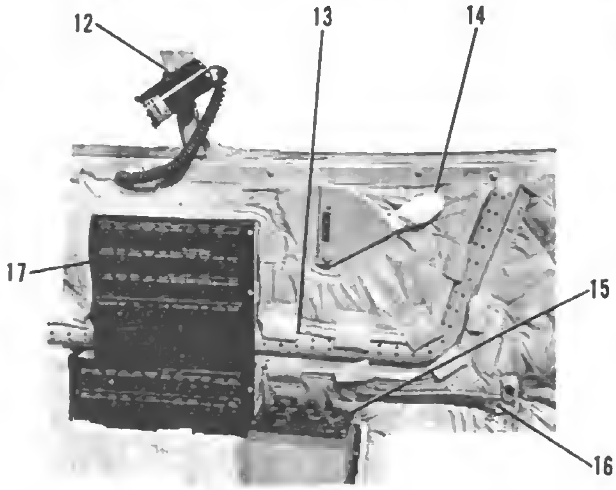


6 LIGHT CONTROL RHEOSTATS
7 COPILOTS CONTROL QUADRANT
8. LF/ADF RADIO
9 PILOTS OXYGEN REGULATOR
10. INTERNAL CANOPY CONTROL SWITCH
11 PILOTS OXYGEN HOSE
11A. OXYGEN HOSE RESTRAINT STRAP



Right Side

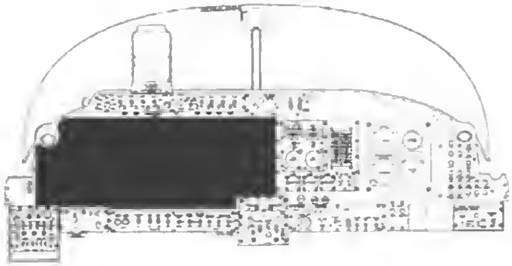
12. COCKPIT LIGHT
13. PICCOLO TUBE
14. CANOPY DOWNLOCK HANDLE
15. INTERPHONE CONTROL PANEL
16. MAP AND DATA CASE
17. CIRCUIT BREAKER PANEL



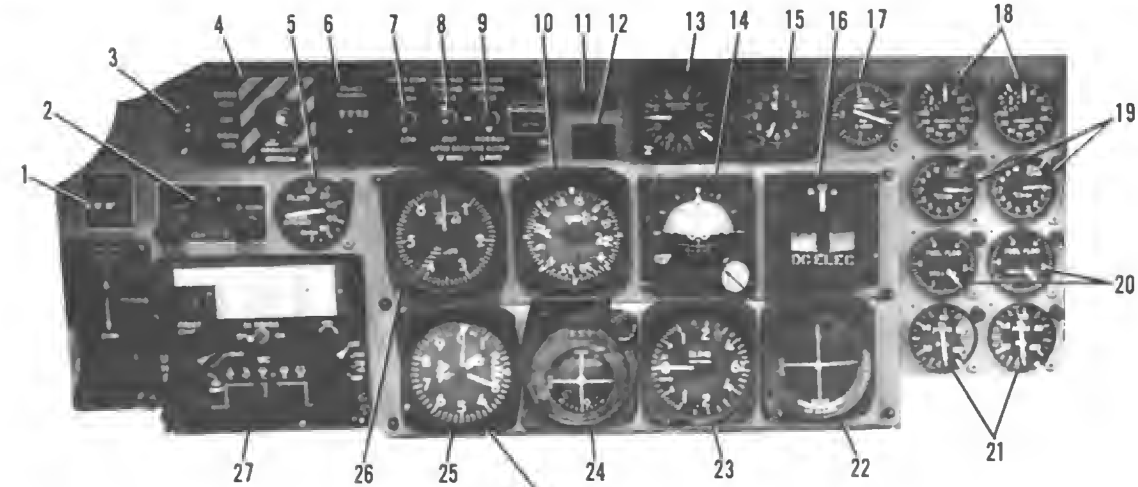
1 AIRCRAFT 69-6388 AND ON AND AIRCRAFT 67-14776 THRU 69-6387 WHEN MODIFIED PER T.O. 1A-37B-524.

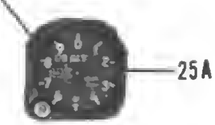
2 AIRCRAFT 70-1292 AND ON AND AIRCRAFT 67-14776 THRU 70-1291 WHEN MODIFIED PER T.O. 1A-37B-554.

Figure 1-3



LEFT INSTRUMENT PANEL





⚠1 AIRCRAFT 67-14776 THRU 69-6417, 69-6436 AND 69-6444 THRU 69-6446 EXCEPT WHEN MODIFIED PER T. O. 1A-37B-506.

⚠2 AIRCRAFT 69-6418 THRU 69-6435, 69-6437 THRU 69-6443, 70-1277 AND ON AND AIRCRAFT 68-7911, 68-7912, 68-7927 THRU 68-7948, 68-7950 THRU 68-7974, 68-10811 THRU 68-10814, 68-10819 THRU 68-10827, 69-6363 THRU 69-6371 AND 69-6378 THRU 69-6399 WHEN MODIFIED PER T. O. 1A-37B-506.

1. LANDING - TAXI LIGHT SWITCH
2. LANDING GEAR POSITION INDICATOR LIGHTS
3. IGNITION SYSTEM SWITCH
4. ARMAMENT JETTISON BUTTON
5. WING FLAP POSITION INDICATOR
6. NOSE GUN ROUNDS REMAINING COUNTER
7. NOSE GUN RATE SWITCH
8. COMPASS SLAVING SWITCH
9. ATTITUDE ERECTION SWITCH
10. BDHI (BEARING-DISTANCE-HEADING INDICATOR)
11. CANOPY WARNING LIGHT
12. MASTER CAUTION LIGHT
13. ACCELEROMETER
14. MM-3 ATTITUDE INDICATOR
15. CLOCK
16. TURN AND SLIP INDICATOR
17. HYDRAULIC PRESSURE INDICATOR
18. TACHOMETERS
19. EXHAUST GAS TEMPERATURE INDICATORS
20. FUEL FLOW INDICATORS
21. OIL PRESSURE INDICATORS
22. APPROACH INDICATOR
23. VERTICAL VELOCITY INDICATOR
24. COURSE INDICATOR
25. AAU-8/A ALTIMETER ⚠1

25A. AAU-21/A ALTIMETER ENCODER ⚠2

26. AIRSPEED INDICATOR
27. UHF RADIO

Figure 1-4

Note

Retarding the throttles rapidly, or when the left engine is shutdown, the ice warning light may occasionally illuminate, due to negative pressure in the ice detect probe.

ENGINE INLET ANTI-ICE SYSTEM

Engine bleed air is supplied to the anti-icing system where it is used to prevent the formation of ice on the engine frontal area. The bleed air is distributed to ducts in the compressor front frame, inlet guide vanes, nose dome, nose dome struts and the forward nacelle area of the inlet ducts. It then flows from these components through small bleed holes and enters the engine primary airstream. It is noted that the system is an anti-icing, not a deicing system, since an actual buildup of ice will block the bleed holes and render the system inoperative.

Note

The engine inlet anti-ice system should not be activated, except for system checkout, at ambient temperature above 40°F. Extended usage of this system at high ambient temperature could cause an overheat condition of the forward nacelle area.

Anti-Ice Inlet Switch

The anti-ice inlet switch located on the air conditioning panel (23, figure 1-6) is a two-position ON-OFF switch. The switch controls two solenoid shutoff valves in the bleed air line, one to the engine and one to the nacelle anti-ice areas. Power is required to hold the valve closed. Placing the switch ON, opens the air valve which starts anti-icing airflow. The complete loss of 28 volt dc power will also allow the valve to open. An increase in EGT of approximately 10° to 20°C may be noted to indicate operation and the amber inlet heat light (5, figure 1-14) on the annunciator panel will be illuminated. With the switch in the OFF position, no anti-icing operation is being performed. Electrical power is provided by the 28 volt dc bus.

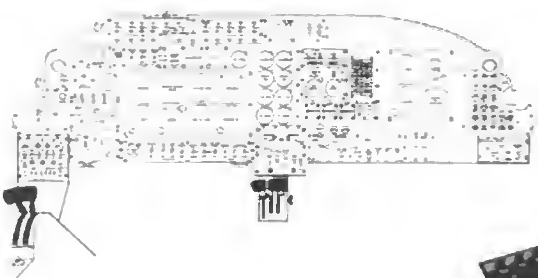
AUTOMATIC ENGINE START SYSTEM

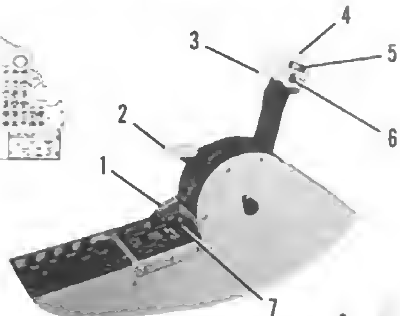
The automatic engine start system contains an ignition generator, two igniters, a timer, a push button engine start switch, and a combination starter-generator for each engine. An external power source is not required for starting the engines.

Engine Start Button

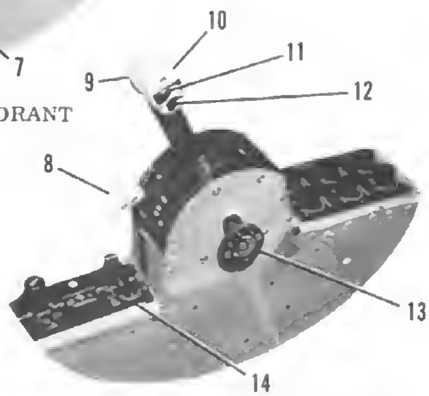
The engine start buttons located on the switch panel (1, figure 1-6), when pressed starts the time delay relay. The relay engages the starter and the ignition

CONTROL QUADRANTS





PILOTS CONTROL QUADRANT



COPILOTS CONTROL QUADRANT

1. GROUND ARM SWITCH
2. WING FLAP LEVER (PILOT)
3. LEFT ENGINE THROTTLE
4. RIGHT ENGINE THROTTLE
5. SPEED BRAKE SWITCH
6. MICROPHONE SWITCH
7. RUDDER TRIM SWITCH
8. WING FLAP LEVER (COPILOT)
9. LEFT ENGINE THROTTLE
10. RIGHT ENGINE THROTTLE
11. SPEED BRAKE SWITCH
12. MICROPHONE SWITCH
13. THROTTLES FRICTION KNOB
14. LF/ADF RADIO

Figure 1-5

generator. Ignition may be heard when starting the first engine and observed on the instrument panel. In an emergency situation, the ignition and cranking cycle can be terminated immediately by pressing the starting button again. The time delay relay will operate the igniters and starter for approximately 30 to 45 seconds. The generator lights on the annunciator panel will extinguish indicating the generator has come on the line.

IGNITION SWITCH

The cover-guarded switch (3, figure 1-4) in the upper left of the instrument panel next to the jettison button, is the ignition control switch. Power for the switch is supplied by the 28 volt dc bus.

Ignition Switch Operation

The ignition switch is a three-position switch, cover-guarded closed in the NORMAL position. In this position 28 volt dc power is provided for ignition of an automatic start when the engine start button is pressed. With the cover raised, the OFF position can be selected which will stop ignition to the engines, and the starter will continue to operate until the time delay relay has completed its cycle. The EMERG position provides a by-pass of the automatic system and applies 28 volt dc power directly to the ignition generators for ignition to both engines as long as the switch is in the EMERG position.

Ignition Indicator Lights

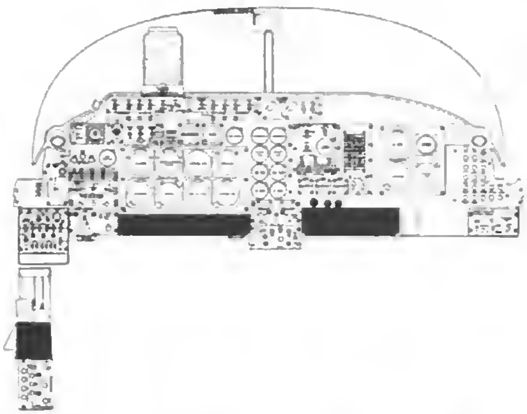
With the ignition switch in the NORMAL position, the ignition indicator lights (3 and 20, figure 1-14) will remain illuminated for 30 to 45 seconds after their respective starter button is depressed. If the starter button is depressed a second time before completion of the time interval, the indicator light will extinguish indicating termination of the starting cycle.

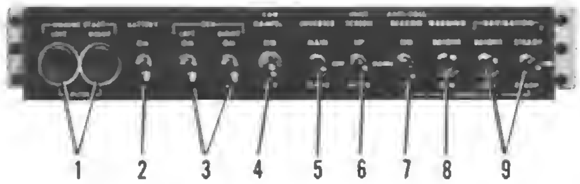
With the ignition switch in the EMERG position, the ignition indicator lights will remain illuminated as long as the ignition switch is in the EMERG position.

CAUTION

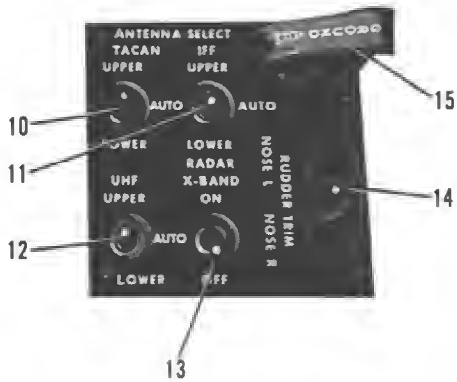
Ignition generators operational time is limited to 45 seconds to prevent the generator from burning up.

SWITCH PANELS

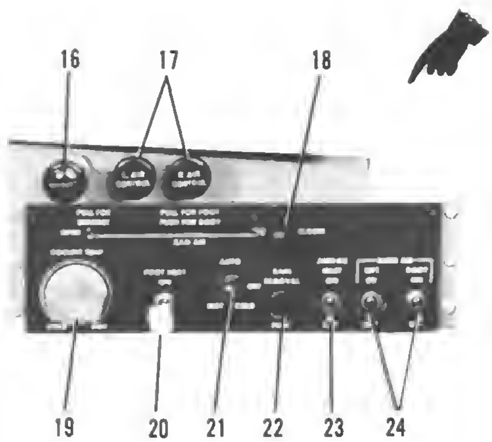




SWITCH PANEL



PILOTS QUADRANT SWITCH PANEL



AIR CONDITIONING PANEL

1. ENGINE START BUTTONS
2. BATTERY SWITCH
3. GENERATOR SWITCHES
4. YAW DAMPER SWITCH
5. INVERTER SWITCH
6. INLET SCREEN SWITCH
7. ANTI-COLLISION BEACON SWITCH
8. WARNING LIGHTS DIMMING SWITCH
9. NAVIGATION LIGHTS SWITCHES
10. TACAN ANTENNA SELECT SWITCH
11. IFF ANTENNA SELECT SWITCH
12. UHF ANTENNA SELECT SWITCH
13. X-BAND BEACON SWITCH
14. RUDDER TRIM SWITCH
15. GROUND ARM SWITCH
16. DEFROST KNOB
17. AIR CONTROL KNOBS
18. RAM AIR LEVER
19. AIR TEMPERATURE CONTROL RHEOSTAT
20. PITOT HEAT SWITCH
21. AIR TEMPERATURE CONTROL SWITCH
22. RAIN REMOVAL BUTTON
23. ANTI-ICE INLET HEAT SWITCH
24. BLEED AIR SWITCHES

Figure 1-6

ENGINE FUEL CONTROL SYSTEM

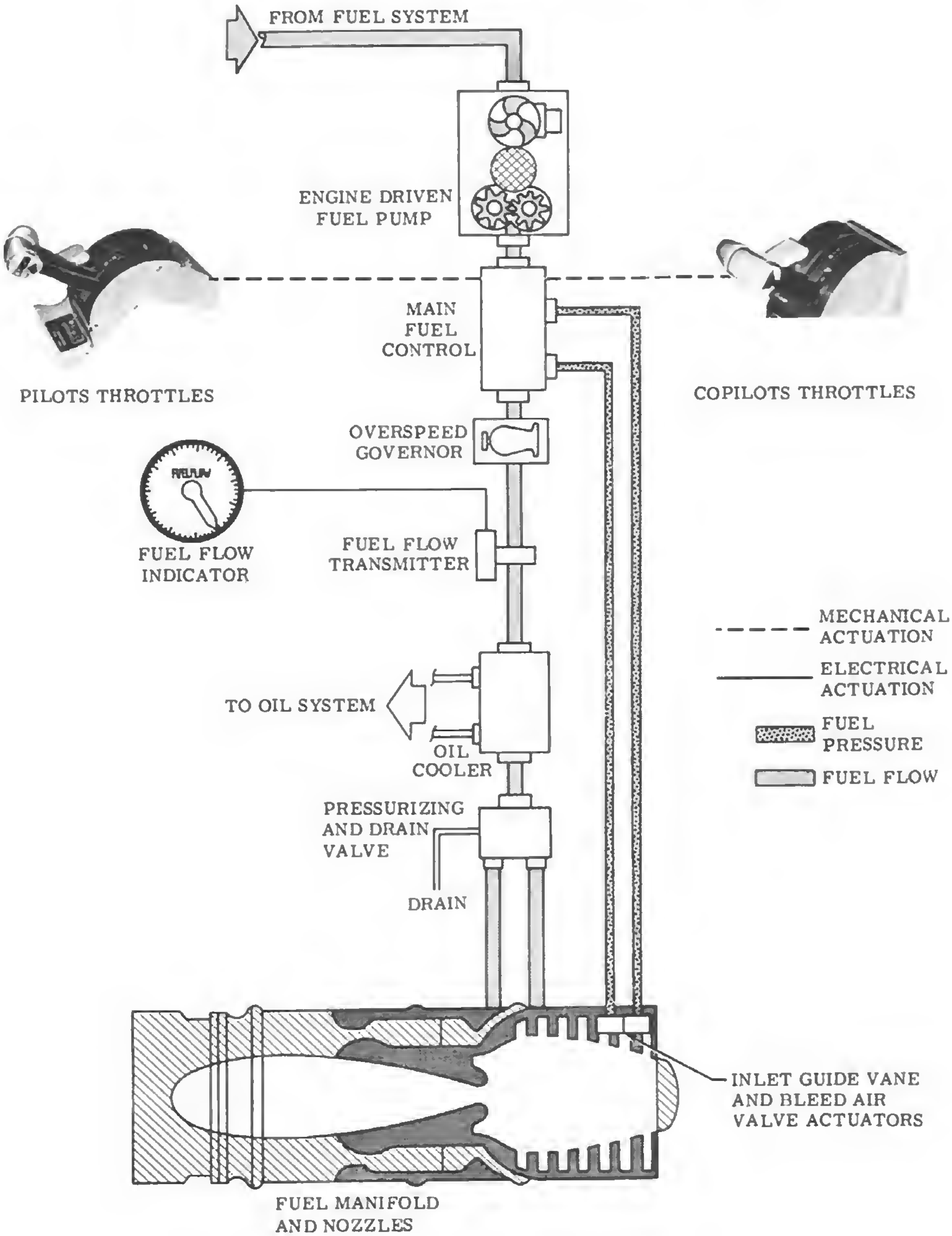


Figure 1-7

ENGINE INSTRUMENTS

Tachometers

The tachometers (18, figure 1-4) are self-generating instruments that indicate engine speed in percentage of the rated rpm. They operate independently of the aircraft electrical system except for instrument lighting. On this aircraft the rated rpm is 16,500 rpm.

Exhaust Gas Temperature Indicators

The exhaust gas temperature indicators (19, figure 1-4), are self-generating instruments that indicate temperature in degrees centigrade. Electrical current for the exhaust gas temperature indicators is supplied by eight thermocouples located in the tailpipe of each engine.

Fuel Flow Indicators

Fuel flow, in pounds per hour to each engine, is indicated by the fuel flow indicators (20, figure 1-4). The fuel flow indicators are powered from the 115 volt three phase ac bus.

Oil Pressure Indicators

The oil pressure indicators (21, figure 1-4) are remote indicating instruments and are operated by the 26 volt single phase ac bus. The indicators indicate oil pressure in pounds per square inch.

OIL SUPPLY SYSTEM

The engine has a pressurized, closed-circuit lubrication system designed to furnish oil to parts requiring lubrication during engine operation. After oil has been supplied to these parts, it drains to the sumps from which it is recovered by the scavenge elements of the lube pump and recirculated to the oil reservoir. All system components are engine furnished and engine mounted. External oil lines are kept at a minimum by the use of internal lines and, cored or drilled passages. The main components of the lube system are a lube and scavenge pump, an oil reservoir, an oil cooler and an oil filter mounted in the lube and scavenge pump. The oil pump does not have an inverted flight scavenge element.

Each engine has an independent oil system, and is a completely automatic system requiring no control action by the pilot. The capacity of each oil system is 4 quarts of oil, of this amount 2. 5 is usable oil. See figure 1-51 for oil specification.

FUEL SUPPLY SYSTEM

Three self-sealing tanks are installed in the aircraft: one in the fuselage and one in each wing. All tanks may be refueled on the ground by gravity refueling through the two wing tank caps and two tip tank caps, or pressure refueled through the air refueling receptacle on the ground or while airborne. All fuel tanks are filled with a foam material to provide fire protection to the aircraft and reduce slosh to a minimum. Six interconnected fuel cells make one wing fuel tank. (See figure 1-8.) One 90 U.S. gallon tip tank is installed on each wing tip. These are dumpable, non-self-sealing fuel tanks. Provisions for four pylon tanks, installed on the pylon stations (inboard and inboard intermediate) are provided for additional fuel, and are drawn from, equally by the fuel proportioners, into the fuselage tank. Provisions for a right-hand seat fuel tank are provided when the ejection seat, seat rails, control stick, and rudder pedals are removed. The tank is self-sealing and fuel is transferred to the fuselage tank by an electrical transfer pump. Fuel is supplied to the engines from the fuselage tank by an electrical fuel boost pump. In normal operation, fuel is transferred, under pressure, from the wing tanks to the fuselage tank in equal quantity by two electrical proportioner pumps. The proportioner pumps operate automatically when the fuel quantity in the fuselage tank drops below a preset level. In emergency operation, fuel is supplied to the fuselage tank from the wing tanks by gravity feed. See figure 1-50 for fuel specification.

CAUTION

Use or dump tip fuel prior to landing, conditions permitting.

Note

Fuel system is limited to 10 seconds negative "G" flight.

FUEL BOOST PUMP

A centrifugal pump is located inside the inverted flight chamber in the bottom of the fuselage tank. It supplies fuel under low, positive pressure to both engines. The pressure helps prevent high altitude engine surge. It also provides fuel to reprime the engine-driven fuel pump in the event of cavitation (air lock). The fuel boost pump is on when the battery switch is ON, (2, figure 1-6). Power is supplied by the 28 volt dc bus.

Fuel Boost Pump Warning Light

A green fuel boost pump warning light on the annunciator panel (15, figure 1-14) provides the pilot with an indication that the fuel boost pump is not providing normal fuel pressure. The light, operated through the action of a pressure switch located in the fuel line, receives its electrical power from the 28 volt dc bus.

Note

The fuel boost pump warning light may flicker momentarily near zero "G" conditions due to a momentary lack of fuel at the boost pump inlet.

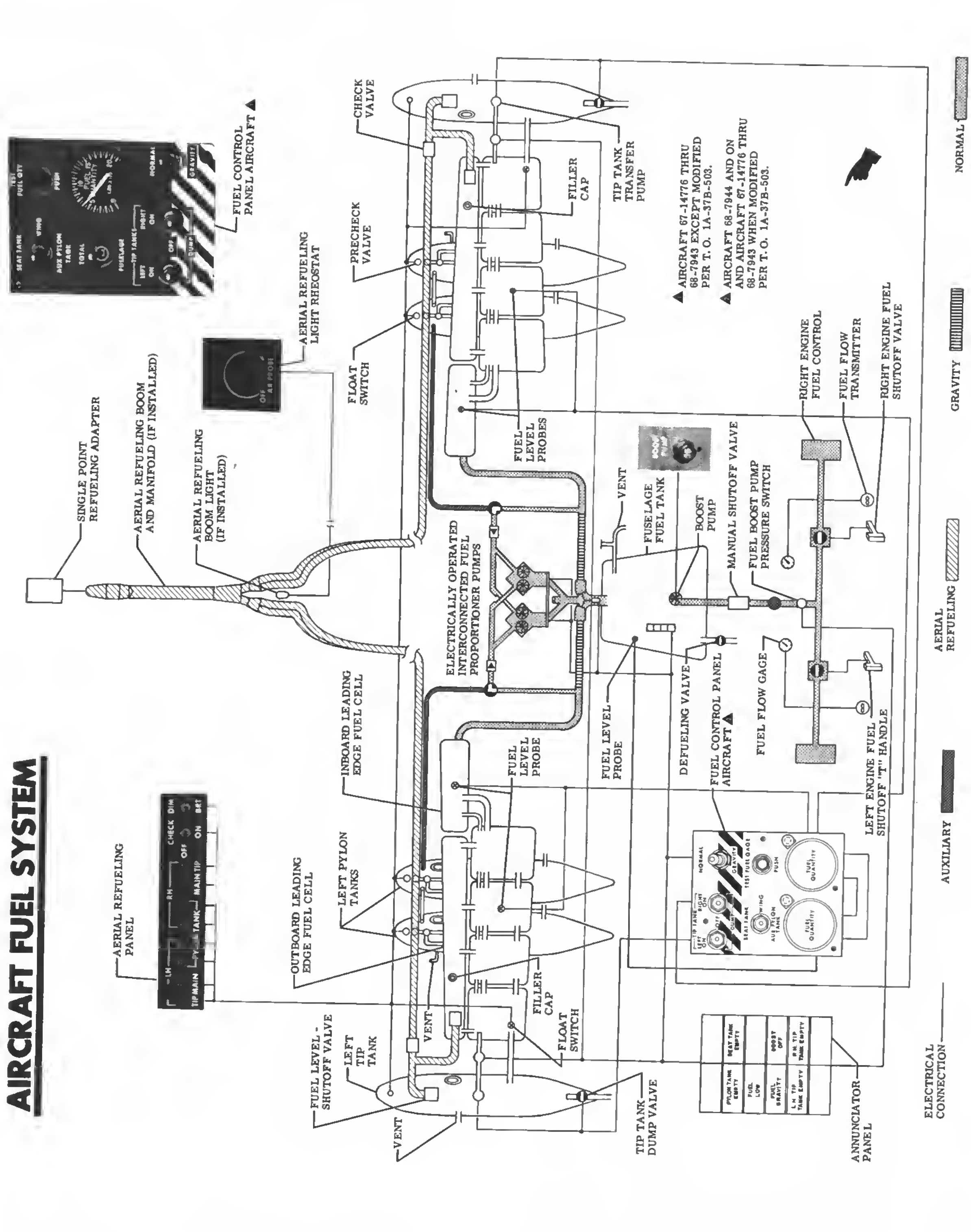

AIRCRAFT FUEL SYSTEM
SINGLE POINT REFUELING ADAPTER
AERIAL REFUELING BOOM AND MANIFOLD (IF INSTALLED)
AERIAL REFUELING BOOM LIGHT (IF INSTALLED)
AERIAL REFUELING LIGHT RHEOSTAT
FUEL CONTROL PANEL AIRCRAFT ▲
CHECK VALVE
PRECHECK VALVE
FLOAT SWITCH
FILLER CAP
TIP TANK TRANSFER PUMP
▲ AIRCRAFT 67-14776 THRU 68-7943 EXCEPT MODIFIED PER T. O. 1A-37B-503.
▲ AIRCRAFT 68-7944 AND ON AND AIRCRAFT 67-14776 THRU 68-7943 WHEN MODIFIED PER T. O. 1A-37B-503.
FUEL LEVEL PROBES
VENT
FUSELAGE FUEL TANK
BOOST PUMP
MANUAL SHUTOFF VALVE
FUEL BOOST PUMP PRESSURE SWITCH
RIGHT ENGINE FUEL CONTROL
FUEL FLOW TRANSMITTER
RIGHT ENGINE FUEL SHUTOFF VALVE
ELECTRICALLY OPERATED INTERCONNECTED FUEL PROPORTIONER PUMPS
INBOARD LEADING EDGE FUEL CELL
FUEL LEVEL PROBE
FUEL LEVEL PROBE
DEFUELING VALVE
FUEL CONTROL PANEL AIRCRAFT ▲
FUEL FLOW GAGE
LEFT ENGINE FUEL SHUTOFF "T" HANDLE
AERIAL REFUELING PANEL
OUTBOARD LEADING EDGE FUEL CELL
LEFT PYLON TANKS
FUEL LEVEL - SHUTOFF VALVE
LEFT TIP TANK
VENT
VENT
FILLER CAP
FLOAT SWITCH
TIP TANK DUMP VALVE
ANNUNCIATOR PANEL
ELECTRICAL CONNECTION
NORMAL
GRAVITY
AERIAL REFUELING
AUXILIARY

Figure 1-8.

FUEL SHUTOFF "T" HANDLES

A fuel shutoff "T" handle (figure 1-2) for each engine is located on the top of the instrument panel. In the PUSH-ON position, a circuit to the motorized fuel shutoff valve is completed which permits 28 volt dc power to open the valves and lets fuel flow from the fuel boost pump to the engine fuel control. When the "T" handle is in the PULL-OFF position the motorized fuel shutoff valve is energized closed. For all normal operating conditions the fuel shutoff "T" handle should be in the PUSH-ON position. Only in an emergency condition should the PULL-OFF position be used. Each "T" handle also contains a 28 volt dc red light which is illuminated when a fire condition exists in a respective engine nacelle.

CAUTION

The fuel shutoff "T" handles are electrical switches and movement is restricted to a very short travel. It takes up to 10 seconds for an engine to stop running after a fuel shutoff "T" handle has been positioned to the PULL-OFF position, if the throttles are set at idle.

FUEL QUANTITY INDICATOR ▲1

A fuel quantity indicator (figure 1-8) indicates the quantity, in pounds, of total or fuselage internal fuel remaining. The fuel quantity indicator receives its power from the single phase 115 volt ac bus.

DUAL FUEL QUANTITY INDICATORS ▲2

The dual fuel quantity indicating system (figure 1-8) indicates the quantity, in pounds, of left and right wing totals on one dual needle indicator while fuselage total and total internal fuel remaining can be read on the other dual needle indicator. The fuel quantity indicators receive power from the single phase 115 volt ac bus.

FUEL GAGING SELECTOR SWITCH ▲1

The fuel gaging selector switch (figure 1-8) has two positions; TOTAL (internal) and FUSELAGE. The switch uses power from the 28 volt dc bus to complete a circuit between the fuel quantity indicator and the fuel cell probes. The switch in the TOTAL position, indicates total internal fuel aboard which does not include pylon tank or tip tank fuel. Fuel remaining in the fuselage tank can be gaged by placing the switch in the FUSELAGE position, until the reading on the fuel quantity indicator stabilizes.

▲1 AIRCRAFT 67-14776 THRU 68-7943 EXCEPT WHEN MODIFIED PER T.O. 1A-37B-503.

▲2 AIRCRAFT 68-7944 AND ON AND AIRCRAFT 67-14776 THRU 68-7943 WHEN MODIFIED PER T.O. 1A-37B-503.

Fuel Quantity Indicator Test Switch

The fuel quantity indicator test switch (figure 1-8) uses power from the 115 volt ac bus during the operational check of the fuel quantity indicator. Pushing in on the fuel quantity test switch allows the fuel quantity indicator needle to deflect toward zero, indicating that the fuel gage is operating.

FUEL SYSTEM SWITCH

The fuel system switch (figure 1-8) provides both normal and gravity operation of the fuel system. The switch has two positions, NORMAL and GRAVITY. The switch in the NORMAL position energizes the solenoid lock fuel shutoff valve to the closed position and alerts the fuel proportioner circuit. With the switch in the GRAVITY position, the fuel proportioner pump circuit and the solenoid lock shutoff valve are de-energized. This allows the solenoid lock shutoff valve to open and the green gravity feed light on the annunciator panel (8, figure 1-14) to illuminate, indicating the fuel system is operating in the gravity feed system. The fuel system receives its power from the 28 volt dc bus.

TIP TANK SWITCHES

The tip tank switches (figure 1-8), one for each tank, are located on the fuel control panel. Each switch has three positions, ON, OFF and DUMP. With the switch in the ON position, ac power is provided to the transfer pumps to transfer fuel from tne selected tip tank to the wing tank. Tip tank fuel will circulate from the wing tank back through the vent tube to the tip tank until the fuel level in the wing tank is lower than the vent opening, for this reason tip tank fuel should not be selected until it is desirable to transfer it. In the OFF position, the pump is inoperative. In the DUMP position, dc power is provided to the motor-driven gate valve which is actuated to the open position and the tank dumps its fuel. To stop dumping fuel, the switch must be positioned to the ON position for approximately 2 seconds, then positioned to OFF.

Note

The best tip dump speed is 135 KIAS (flaps up, level flight). At this speed the time required to empty the tips is approximately 2 minutes and 20 seconds.

TIP TANK EMPTY LIGHT

Note

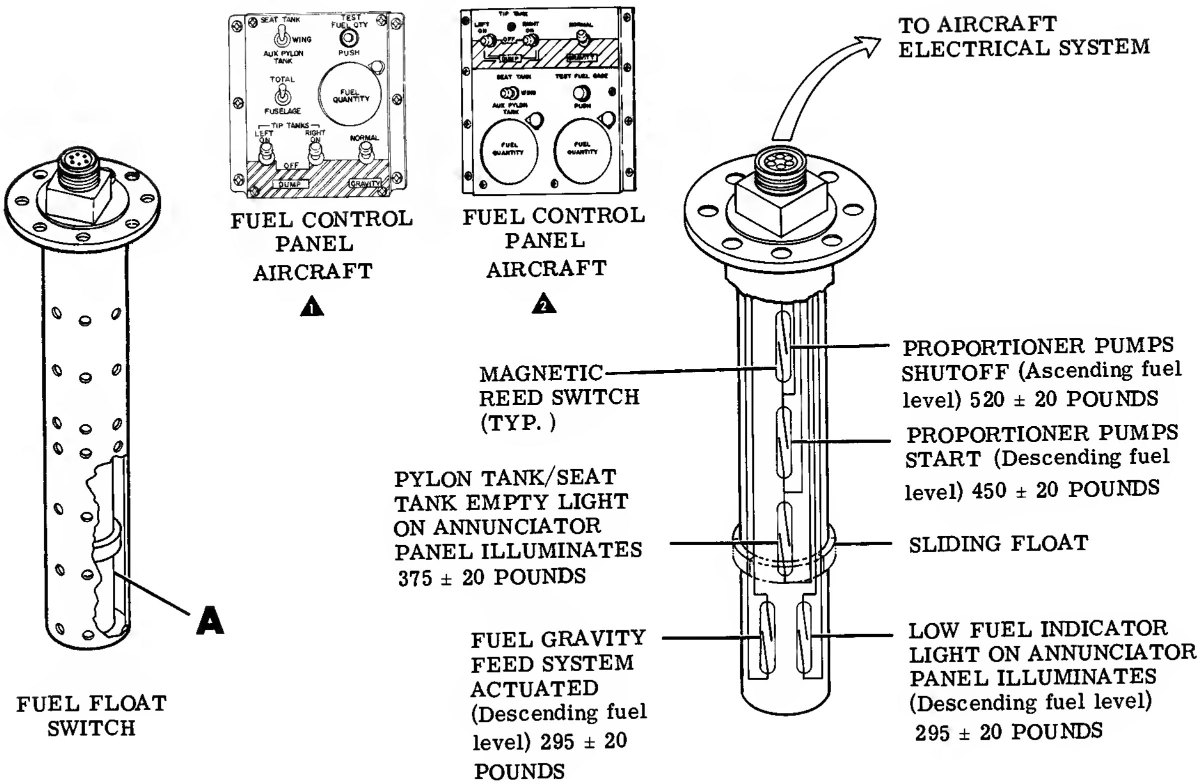
Monitor the annunciator panel when tip tank switches are ON. Continuous illumination of R TIP TANK EMPTY or L TIP TANK EMPTY light indicates that tip tanks are empty. Switches should be positioned to OFF to prevent burning out the tip tank transfer pumps.

A green tip tank fuel transfer pump warning light (7 and 16, figure 1-14), one for each pump, is located on the annunciator panel. These lights illuminate when the tip tank switches are on and no fuel is being transferred. When the tip tank switches are actuated to the ON position, the warning lights will momentarily illuminate until pressure is built up. When pressure is built up the lights will go out and stay out as long as fuel is being transferred to the wing tanks. The lights will again illuminate when the tanks are empty. When the tanks are empty the switches should be positioned to OFF and the lights will go out.

FUEL SELECTOR SWITCH

The fuel selector switch is located on the fuel control panel. This switch has three positions, SEAT TANK, WING and AUX PYLON TANK. When the switch is in the SEAT TANK position, fuel is transferred from the seat tank to the fuselage tank by a transfer pump. To stop the transferring of fuel the switch must be positioned to WING. With the switch in the AUX PYLON TANK position, fuel is drawn from the pylon tanks by the fuel proportioner pumps to the fuselage tank. To stop the transferring of fuel the switch

FUSELAGE FUEL FLOAT SWITCH



1 AIRCRAFT 67-14776 THRU 68-7943 EXCEPT MODIFIED PER T. O. 1A-37B-503.

2 AIRCRAFT 68-7944 AND ON AND AIRCRAFT 67-14776 THRU 68-7943 WHEN MODIFIED PER T. O. 1A-37B-503.

DETAIL A
INTERNAL VIEW
FOUR LEVEL FLOAT
SWITCH SCHEMATIC

Figure 1-9

must be positioned to WING. In the WING position fuel will be transferred from the wing tanks to the fuselage tank.

Note

- When using seat tank fuel or auxiliary pylon fuel, the tip tank switches should be placed in the OFF position to prevent the tip tank pumps from running and circulating wing and tip fuel.
- Seat tank fuel cannot be jettisoned or dumped.

PYLON TANKS EMPTY WARNING LIGHT

An amber pylon tank fuel warning light is located on the annunciator panel (10, figure 1-14). When the fuel selector switch is actuated to the AUX PYLON TANKS position the warning light will stay out as long as fuel is being transferred to the fuselage tank. The light will illuminate when the tanks are empty, and operates through the action of a fuel float switch located in the fuselage tank and receives its power from the 28 volt dc bus. When the tanks are empty the switch should be positioned to WING and the light will go out.

CAUTION

Pylon tanks will be installed and used in pairs to prevent proportioner pump failure.

SEAT TANK EMPTY WARNING LIGHT

An amber seat tank empty light is located in the annunciator panel, (13, figure 1-14). The light will

FUEL QUANTITY DATA

TOTAL USABLE FUEL IN U.S. GALLONS AND POUNDS		
WITHOUT PYLON TANKS	457.5 GALLONS	2973.7 POUNDS
WITH TWO 97.3 GALLON PYLON TANKS	652.1 GALLONS	4238.6 POUNDS
WITH FOUR 97.3 GALLON PYLON TANKS	846.7 GALLONS	5503.5 POUNDS

TANKS	USABLE FUEL IN LEVEL FLIGHT	
FUSELAGE	79 GALLONS	513.5 POUNDS
WINGS 99.25 GAL. EACH	198.5 GALLONS	1290.0 POUNDS
TIP TANKS 90.0 GAL. EACH	180 GALLONS	1170.0 POUNDS
PYLON TANKS 97.3 GAL. EACH	(TWO) 194.6 GALLONS (FOUR) 389.2 GALLONS	1264.9 POUNDS 2529.8 POUNDS

NOTE: POUNDS SHOWN ARE APPROXIMATE FOR STANDARD DAY CONDITIONS ONLY AND ARE BASED ON 6.5 POUNDS PER GALLON OF JP-4 FUEL.

Figure 1-10

illuminate when the tank is empty, and operates through the action of a fuel float switch located in the fuselage tank and receives its power from the 28 volt dc bus. The fuel selector switch should be positioned in the WING position and the light will go out.

FUEL LOW LEVEL WARNING LIGHT

The amber fuel low level caution light on the annunciator panel (9, figure 1-14) will illuminate when fuel in the fuselage tank reaches a level of approximately 295 ±20 pounds. This light operates through the action of a fuel low level float switch located in the fuselage tank and receives its power from the 28 volt dc bus.

FUEL GRAVITY LIGHT

A green light on the annunciator panel (8, figure 1-14) provides the pilot with an indication that the fuel system is on gravity feed. The gravity feed light is powered by the 28 volt dc bus through the operation of the solenoid lock fuel shutoff valve and the fuselage fuel tank float switches.

AIR REFUELING (IF INSTALLED)

Air refueling, authorized on aircraft ▲, permits all internal and external fuel tanks, except the seat tank, to be filled in-flight or at a single point on the ground.

▲ AIRCRAFT 68-10777 AND ON AND AIRCRAFT MODIFIED PER T.O. 1A-37B-518.
▲20 AIRCRAFT 70-1292 AND ON AND AIRCRAFT MODIFIED PER T.O. 1A-37B-548.

On aircraft ▲20, a refueling probe extension has been added between the nozzle and the adapter on the forward end of the probe to prevent damage to the aircraft while attempting to hook up with the tanker aircraft. Fuel is received through the air refueling probe and routed in equal quantities, by fuel lines, to the right and left wing fuel system (see figure 1-8). Each fuel tank has a fuel level control valve, which automatically shuts off incoming fuel when the tank is full. When the aircraft has 440 ±30 pounds of fuel, and fuel is applied to the refueling probe at 50 ±5 PSI pressure, the internal and tip tanks will fill in three to four minutes. When the pylon tanks are also to be filled, the time required to fill the tanks is four to five minutes. Refer to T. O. 1-1C-1-22 for tactics and procedures used during air refueling.

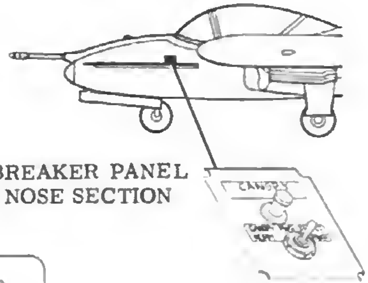
WARNING

The ram air ventilation scoop shall be in the CLOSED position during all refueling operations. If an air conditioning failure has made ram air ventilation mandatory, the pilot should close the ram air scoop and go on oxygen during refueling operations.

AIR REFUELING PANEL

The air refueling panel (figure 1-13) located on the windshield canopy bow, provides a three-position air refueling switch, a two-position light control switch and eight tank full lights.

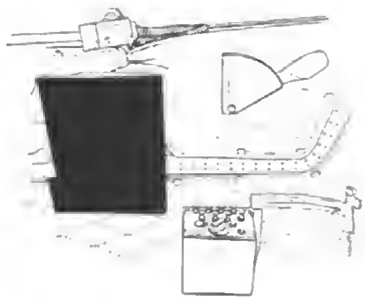
AC FUSE PANEL, CIRCUIT BREAKER PANELS AND

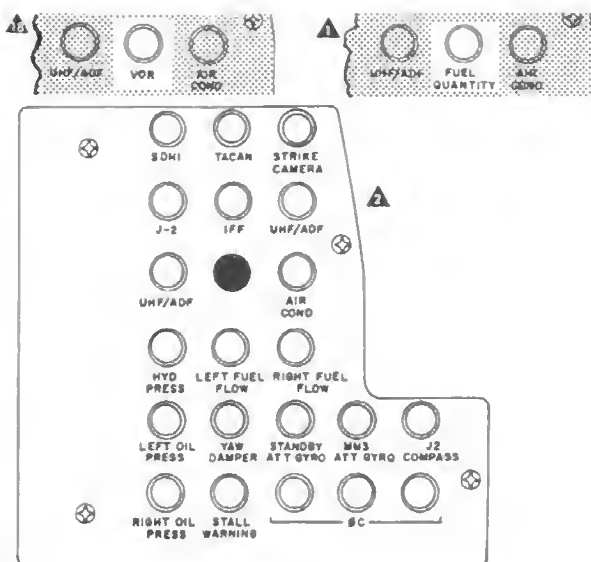


CIRCUIT BREAKER PANEL IN LEFT NOSE SECTION

COCKPIT RIGHT SIDE CIRCUIT BREAKER PANEL

PILOTS CONSOLE ARMAMENT RELAY CIRCUIT BREAKERS



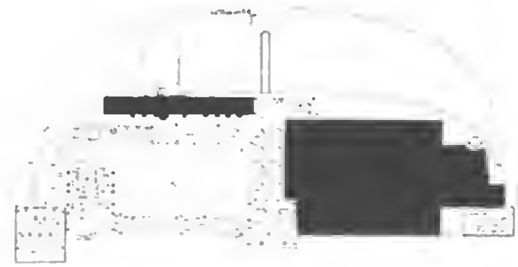


AC FUSE PANEL

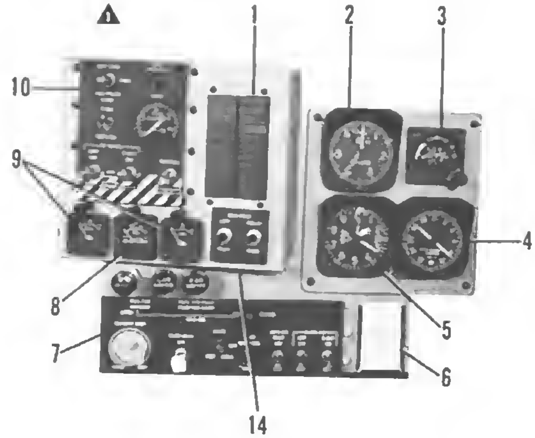
1. AIRCRAFT 67-14776 THRU 68-7943 EXCEPT WHEN MODIFIED PER T. O. 1A-37B-503.
2. AIRCRAFT 68-7944 AND ON AND AIRCRAFT 67-14776 THRU 68-7943 WHEN MODIFIED PER T. O. 1A-37B-503.
3. AIRCRAFT 67-14776 THRU 68-10814, 68-10819 THRU 69-6371 AND 69-6377 THRU 69-6417 AND 69-6444 THRU 69-6446 EXCEPT WHEN MODIFIED PER T. O. 1A-37B-506.
4. AIRCRAFT 69-6418 THRU 69-6427, 69-6437 THRU 69-6443, 70-1277 AND ON AND AIRCRAFT 68-7911, 68-7912, 68-7927 THRU 68-7948, 68-7950 THRU 68-7974, 68-10811 THRU 68-10814, 68-10819 THRU 68-10827, 69-6363 THRU 69-6371 AND 69-6378 THRU 69-6399 WHEN MODIFIED PER T. O. 1A-37B-506.
5. AIRCRAFT 71-790 AND ON AND AIRCRAFT 67-14776 THRU 70-1312 WHEN MODIFIED PER T. O. 1A-37B-552.
6. AIRCRAFT 68-10815 THRU 68-10818, 69-6372 THRU 69-6376 AND 69-6428 THRU 69-6436.

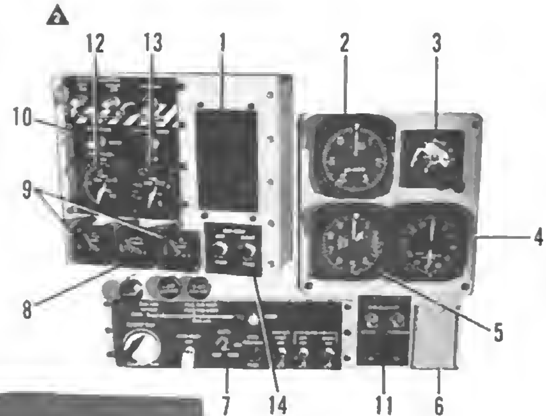
Figure 1-11 (Sheet 1 of 2)

RIGHT INSTRUMENT PANEL



1. ANNUNCIATOR PANEL
2. AIRSPEED INDICATOR
3. STAND-BY ATTITUDE INDICATOR
4. GYRO MAGNETIC COMPASS INDICATOR
5. AAU-8 A ALTIMETER
6. MAGNETIC COMPASS CORRECTION CARD
7. AIR CONDITIONING PANEL
8. VOLTMETER
9. LOADMETERS
10. FUEL CONTROL PANEL
11. FUEL QUANTITY INDICATOR FUSE PANEL
12. FUSELAGE AND TOTAL FUEL QUANTITY INDICATOR
13. LEFT AND RIGHT WING FUEL QUANTITY INDICATOR
14. GENERATOR RESET BREAKERS





ARMAMENT CIRCUIT BREAKER PANEL

△2 AIRCRAFT 68-7974 AND ON AND AIRCRAFT 67-14776 THRU 68-7973 WHEN MODIFIED PER T. O. 1A-37B-504.
△1 AIRCRAFT 67-14776 THRU 68-7973 EXCEPT AIRCRAFT MODIFIED PER T. O. 1A-37B-504.

Figure 1-11 (Sheet 2 of 2)

ELECTRICAL POWER

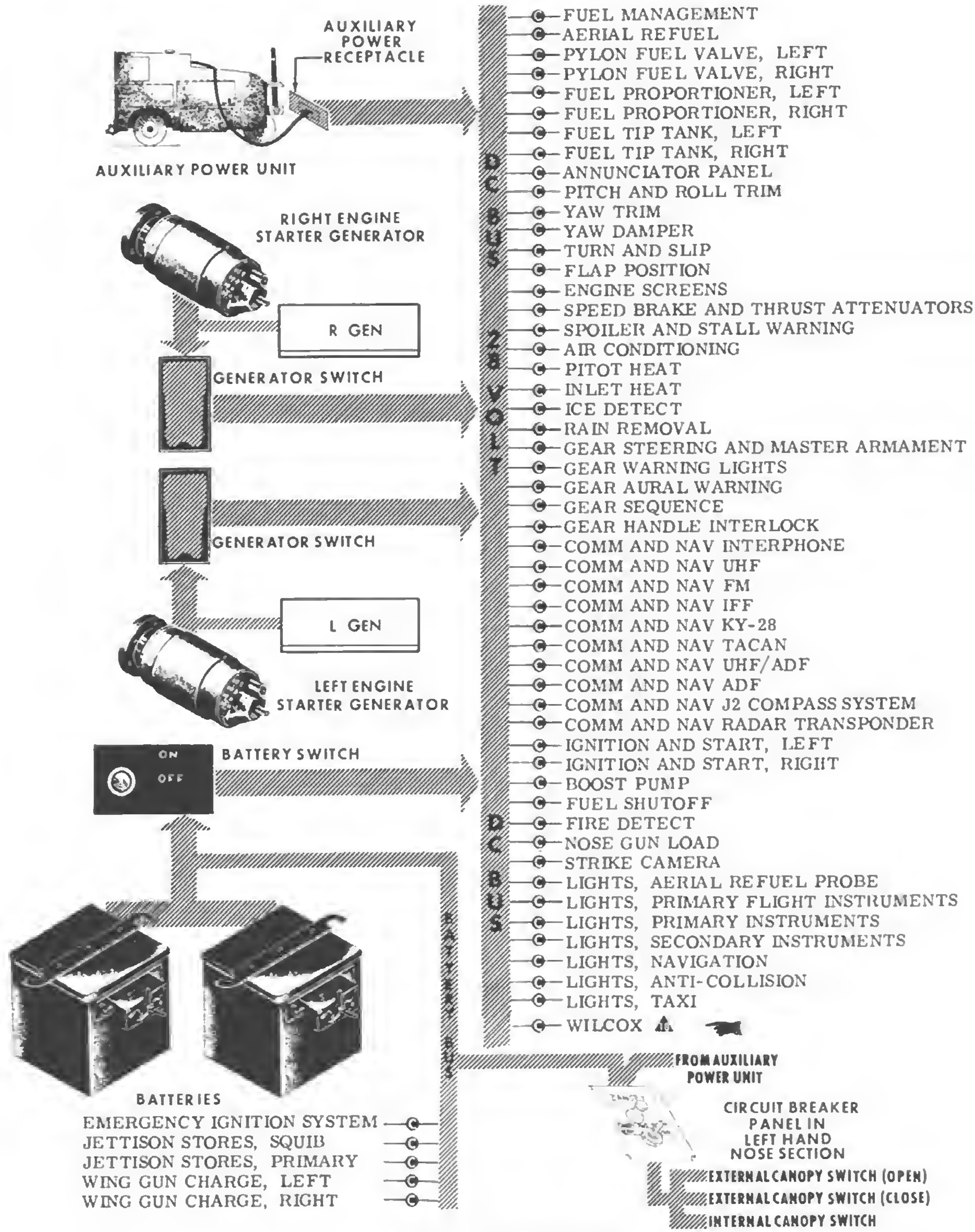
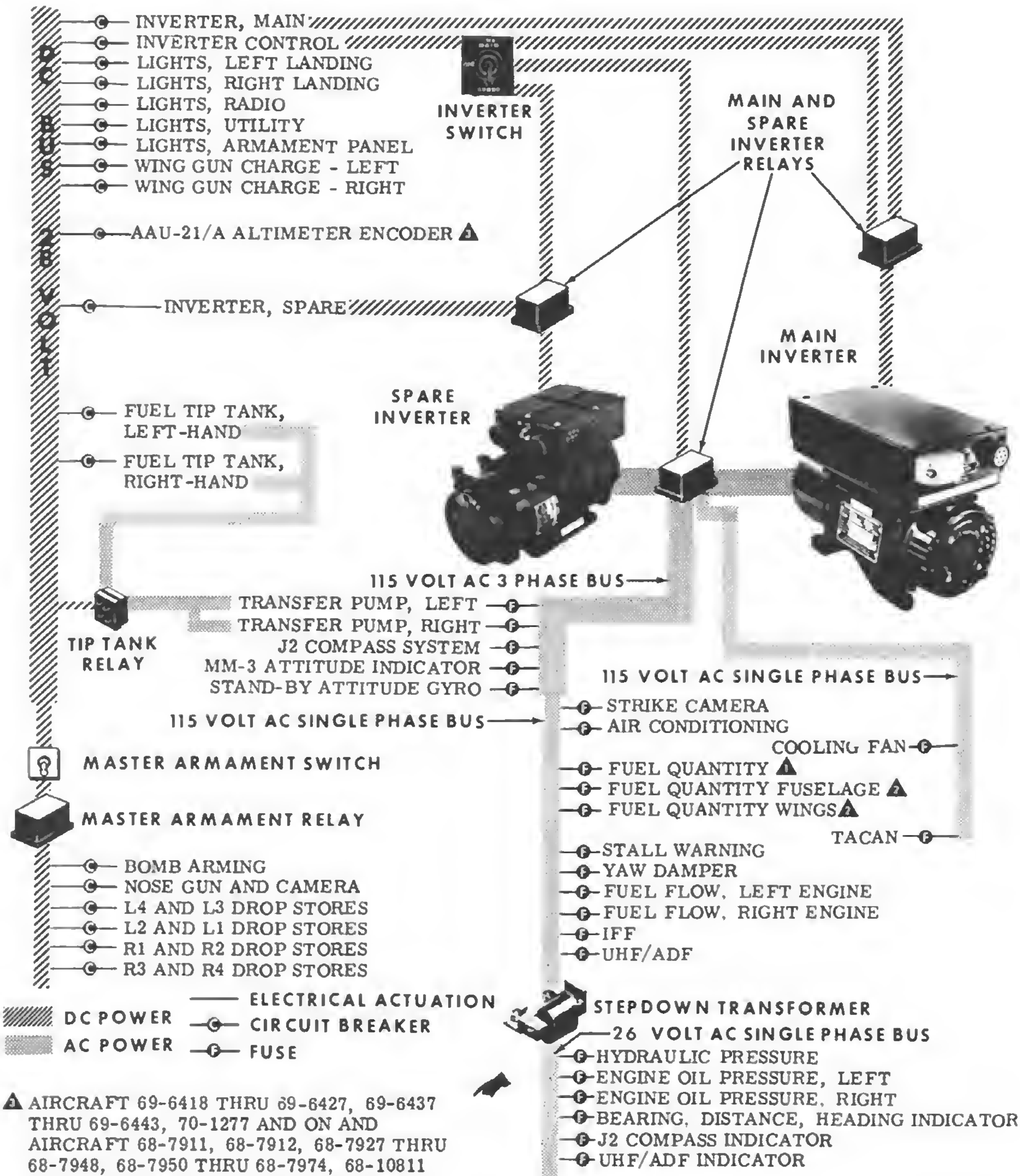


Figure 1-12 (Sheet 1 of 2)

SUPPLY SYSTEM



[3] AIRCRAFT 69-6418 THRU 69-6427, 69-6437 THRU 69-6443, 70-1277 AND ON AND AIRCRAFT 68-7911, 68-7912, 68-7927 THRU 68-7948, 68-7950 THRU 68-7974, 68-10811 THRU 68-10814, 68-10819 THRU 68-10827, 69-6363 THRU 69-6371 AND 69-6378 THRU 69-6399 WHEN MODIFIED PER T. O. 1A-37B-506.

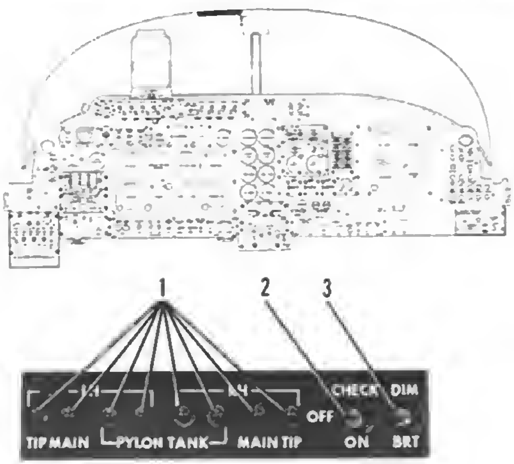
[4] AIRCRAFT 68-10815 THRU 68-10818, 69-6372 THRU 69-6376 AND 69-6428 THRU 69-6436.

[1] AIRCRAFT 67-14776 THRU 68-7943 EXCEPT MODIFIED PER T. O. 1A-37B-503.

[2] AIRCRAFT 68-7944 AND ON AND AIRCRAFT 67-14776 THRU 68-7943 WHEN MODIFIED PER T. O. 1A-37B-503.

Figure 1-12 (Sheet 2 of 2)

AERIAL REFUELING PANEL



1. TANK FULL LIGHTS
2. AIR REFUELING SWITCH
3. DIMMING CONTROL FOR AREIAL REFUELING PANEL LIGHTS

Figure 1-13

Air Refueling Panel Operation

The three-position air refueling switch (2, figure 1-13) is labeled CHECK, OFF and ON. In the CHECK position 28 volt dc power is provided to check the system and illuminate the tank full lights (1, figure 1-13). In the OFF position 28 volt dc power is disconnected. The ON position provides 28 volt dc power to illuminate the indicator lights as the respective tanks are full.

The light control switch (3, figure 1-13) is a two-position switch. The BRIGHT and DIM positions provide for day or night operation.

AIR REFUELING PROBE LIGHT AND SWITCH

The air refueling probe light is located above the boom on the nose and provides for probe and drogue illumination if installed.

Air Refueling Probe Light Switch

The air refueling probe light switch is located on the light control panel on the center console (6, figure 1-38). The rheostat type switch provides 28 volt dc power to the probe light and control of the amount of illumination provided. The rheostat has an OFF position and rotation clockwise will increase the light intensity to the BRT position.

ELECTRICAL POWER SUPPLY SYSTEM

For a complete reference of power distribution to electrically operated equipment, see figure 1-12.

DC ELECTRICAL POWER DISTRIBUTION

The 28 volt dc power supply system is powered by two engine-driven 300 ampere generators and two 24 volt 22-ampere-hour batteries. The batteries located in the left-hand nose section, are used to supply current to the dc bus if both generators fail. The dc generators function as starter-generators, cranking the engines until the engines have accelerated to operational speed and then cutting in as generators after engine speed reaches approximately 48 to 50% rpm. Higher than 65% rpm may be required for the generators to carry the equipment load and/or to compensate for low battery conditions. The generators and generator controls are protected by fuses located in the left-hand nose section and others located in the cockpit behind each ejection seat and circuit breakers marked IGN & START, LEFT, RIGHT located on the cockpit right side circuit breaker panel.

EXTERNAL POWER RECEPTACLE

The dc power system can be connected to an external power source through the external power receptacle (figure 1-50), located on the left-hand nose section.

DC CIRCUIT BREAKERS

The dc electrical power supply system is protected by push-pull type circuit breakers (figure 1-11) mounted on two separate panels. The circuit breaker for the canopy is located on a panel in the left-hand nose section and is not accessible during flight. The remaining circuit breakers are located on the right side of the cockpit. The circuit breakers function to protect the dc power system by disengaging automatically whenever an overload or short circuit exists. Should a circuit breaker pop out, it can be reset by manually pushing in on the circuit breaker. A dc circuit can also be opened manually by pulling out on the respective circuit breaker for the line.

CAUTION

Circuit breakers should not be pulled or reset without a thorough understanding of all the effects and results. Use of the circuit breakers can eliminate from the system some related warning system or interlocking circuit. A circuit breaker that continues to pop out after being reset, could result in an electrical fire and further attempts to reset it should be discontinued.

BATTERY SWITCH

The battery switch (2, figure 1-6), has two positions, ON and OFF, which control the circuit accordingly. When the switch is in the ON position, the batteries are connected in parallel to the 28 volt dc bus and the fuel boost pump is in operation. In the OFF position 28 volt dc power is disconnected.

GENERATOR SWITCHES

The dc generator switches (3, figure 1-6), have two positions, ON and OFF and function to connect generator output to the 28 volt dc bus. Generator warning lights (6 and 17, figure 1-14), are on the annunciator panel and will illuminate during engine ground or air-start and will extinguish after the engines start. When the illumination of the indicator lights prevail, an electrical generator system failure has occured.

GENERATOR RESET BREAKERS

Generator overvoltage breakers are installed on each generator to protect the electrical system from over-voltages. If an overvoltage should occur, the right or left overvoltage breaker (14, figure 1-11) will trip. The overvoltage breaker, when tripped, does not extend as do the other circuit breakers. The malfunctioning generator will be indicated by illumination of the L GEN or R GEN caution light.

CAUTION

Care must be exercised to assure that the correct reset button is pushed while the generator is on the line. If breaker button pops out more than 3 times after resetting, it should be left out to prevent damage to equipment and possible fire.

LOADMETERS

The loadmeters (9, figure 1-11), one for each generator, are calibrated to read from -.1 to +1.25 and indicate the proportion of generator rated output being used.

VOLTMETER

The voltmeter (8, figure 1-11), located between the loadmeters on the lower canted panel, indicates the regulated voltage. The voltmeter scale is calibrated from 0 to 30 volts with the normal range from 22 to 29.5 volts. The regulators are set at 28.5 volts, this will vary with temperature and operating conditions.

AC ELECTRICAL POWER DISTRIBUTION

The ac power supply system is powered by a 2500 va three phase 400 cycle main inverter. A spare inverter of 750 va three phase 400 cycle is provided as a safety feature and when manually selected will assume the ac load of the aircraft, except the TACAN and the cooling fan, if the main inverter fails. Alternating current, distributed through three bus networks, and by the use of a transformer, supplies separate voltage systems. Power for the inverters is supplied by the aircraft's dc system.

INVERTER SWITCH

The inverter switch (5, figure 1-6), has three positions; OFF, MAIN and SPARE. MAIN is the position for all normal operation and TACAN operation. SPARE position is for selecting the spare inverter if the main inverter fails, giving normal operation except for the TACAN and the cooling fan. OFF position disconnects 28 volt dc power from the inverters. Normally, the main inverter supplies power for all ac operated equipment. Inverter failure can be detected by observing the INVERTER OUT light on the annunciator panel and the off flag on the MM-3. Selection of the other inverter will turn the light out.

CAUTION

Ground operation of the SPARE inverter is limited to 15 minutes to prevent overheating. Continuous ground operation of the MAIN inverter is permitted if both engines are operating and the Bleed Air Switches are in the ON position.

AC FUSES

All of the ac circuits are protected by fuses (figure 1-11) which are replaceable during flight. Spare fuses are located on the underside of the glare shield, above the right instrument panel. The fuse holder cap will illuminate when the fuse blows.

CAUTION

When replacing a blown fuse, a fuse of like amperage should be used as a replacement.

Note

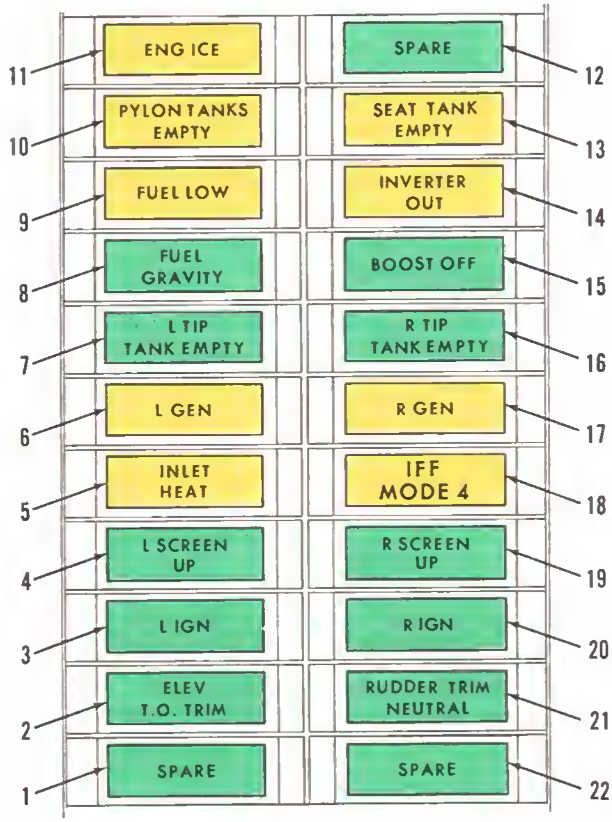
While replacing a fuse, the inverter should be turned off, if practicable, to prevent the pilot from receiving a shock.

ANNUNCIATOR PANEL, CAUTION AND WARNING LIGHTS

The annunciator panel (figure 1-14), located to the right of the fuel control panel, contains nine amber caution lights and ten green advisory lights. The amber MASTER CAUTION light and red canopy-not-locked warning light are located on the left instrument panel. Each light is lettered to reduce surveillance to a minimum while readily indicating an event or malfunction to the pilot. The lights receive their power from the 28 volt dc bus.

When a safety of flight condition exists, requiring immediate corrective action, a red warning light will illuminate. When an impending dangerous condition exists, requiring attention but not necessarily immediate action, the applicable amber caution light on the annunciator panel will illuminate in conjunction with the amber MASTER CAUTION light. A green advisory light on the annunciator panel will illuminate to indicate a safe or normal configuration, condition of performance, operation of essential equipment, or to attract attention and impart information for routine action purposes.

ANNUNCIATOR PANEL



1. SPARE
2. ELEVATOR TAKE-OFF TRIM
3. LEFT IGNITION
4. LEFT SCREEN UP
5. INLET HEAT
6. LEFT GENERATOR
7. LEFT TIP TANK EMPTY
8. FUEL GRAVITY
9. FUEL LOW LEVEL
10. PYLON TANKS EMPTY
11. ENGINE ICE
12. SPARE
13. SEAT TANK EMPTY
14. INVERTER OUT
15. FUEL BOOST OFF
16. RIGHT TIP TANK EMPTY
17. RIGHT GENERATOR
18. IFF MODE 4 ⚠
19. RIGHT SCREEN UP
20. RIGHT IGNITION
21. RUDDER TRIM NEUTRAL
22. SPARE

Figure 1-14

Master Caution Light

The MASTER CAUTION light (figure 1-14) operates in conjunction with the amber annunciator panel caution lights It is only necessary to monitor the MASTER CAUTION light for an indication of an impending dangerous condition requiring attention and then refer to the annunciator panel for the specific condition. The MASTER CAUTION light may be extinguished by depressing the MASTER CAUTION light. This will clear the MASTER CAUTION light for any additional condition that requires attention. Extinguishing the MASTER CAUTION light will not cause the illuminated amber light on the annunciator panel to extinguish The lights on the annunciator panel which will illuminate in conjunction with the MASTER CAUTION light are: ENG ICE, PYLON TANKS EMPTY, SEAT TANK EMPTY, FUEL LOW, INVERTER OUT, L GEN, R GEN, INLET HEAT and IFF MODE 4 ⚠. The MASTER CAUTION light receives its power from the 28 volt dc bus.

⚠ AIRCRAFT 69-6418 THRU 69-6435, 69-6437 THRU 69-6443, 70-1277 AND ON AND AIRCRAFT 68-7911, 68-7912, 68-7927 THRU 68-7948, 68-7950 THRU 68-7974, 68-10811 THRU 68-10814, 68-10819 THRU 68-10827, 69-6363 THRU 69-6371 AND 69-6378 THRU 69-6399 WHEN MODIFIED PER T. O. 1A-37B-506.

Annunciator Lights Dimming Switch

The annunciator lights dimming switch (8, figure 1-6), has two positions: BRIGHT and DIM. It controls the intensity of all annunciator panel lights. The switch receives its power from the 28 volt dc bus, and is protected by an individual circuit breaker (figure 1-11).

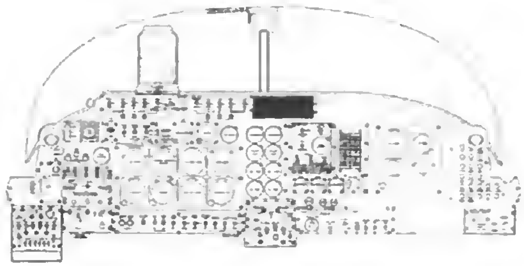
Annunciator Panel, Caution and Warning Lights, Test Button

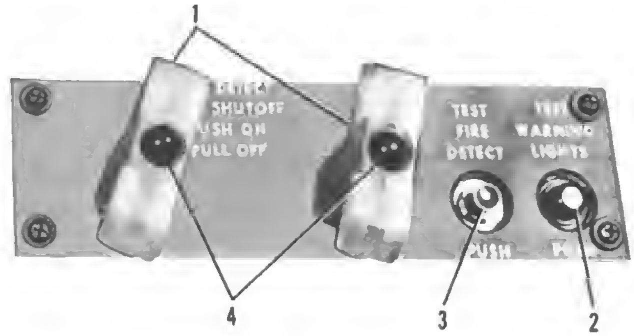
Note

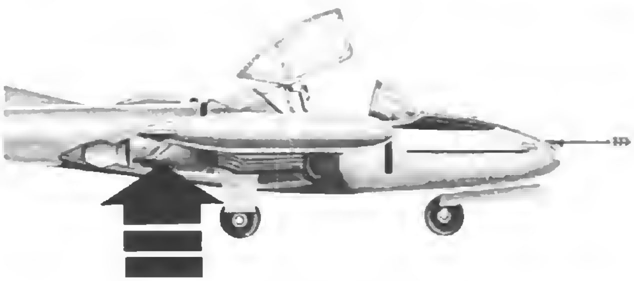
> The lights in the annunciator panel must not be turned or canted in the panel or the lights may not illuminate.

The annunciator panel, caution and warning lights may be functionally tested by depressing the test button marked TEST WARNING LIGHTS, PUSH (2, figure 1-15) located on the engine fire detect system panel. In addition, the sequence or ready lights, the warning light and audible warning tone are also tested

ENGINE FIRE DETECT SYSTEM







1. FUEL SHUTOFF "T" HANDLES
2. WARNING LIGHTS TEST BUTTON
3. FIRE DETECT TEST BUTTON
4. FIRE WARNING LIGHTS

Figure 1-15

by this button. If any light fails to illuminate, that bulb should be replaced and the circuit retested The test button receives its power from the 28 volt dc bus.

ENGINE FIRE DETECT SYSTEM

An engine fire detect system (figure 1-15) is provided to show a visible warning of a fire in either nacelle. A heat sensitive detector cable is installed in each nacelle compartment and is electrically connected to the warning lights in the cockpit.

Engine Fire Detect Warning Lights

The warning lights are mounted in the fuel shutoff T-handles. A steady illumination of the red warning light indicates a fire in the corresponding engine nacelle compartments. Operation of the fire detect system and lights can be checked by the system test switch. The lights receive their power from the 28 volt dc bus.

Engine Fire Detect Switch

The fire detect test switch (3, figure 1-15), when pressed, energizes the entire fire detect circuit and a steady red light in both fuel shutoff T-handles should come on. The switch receives its power from the 28 volt dc bus.

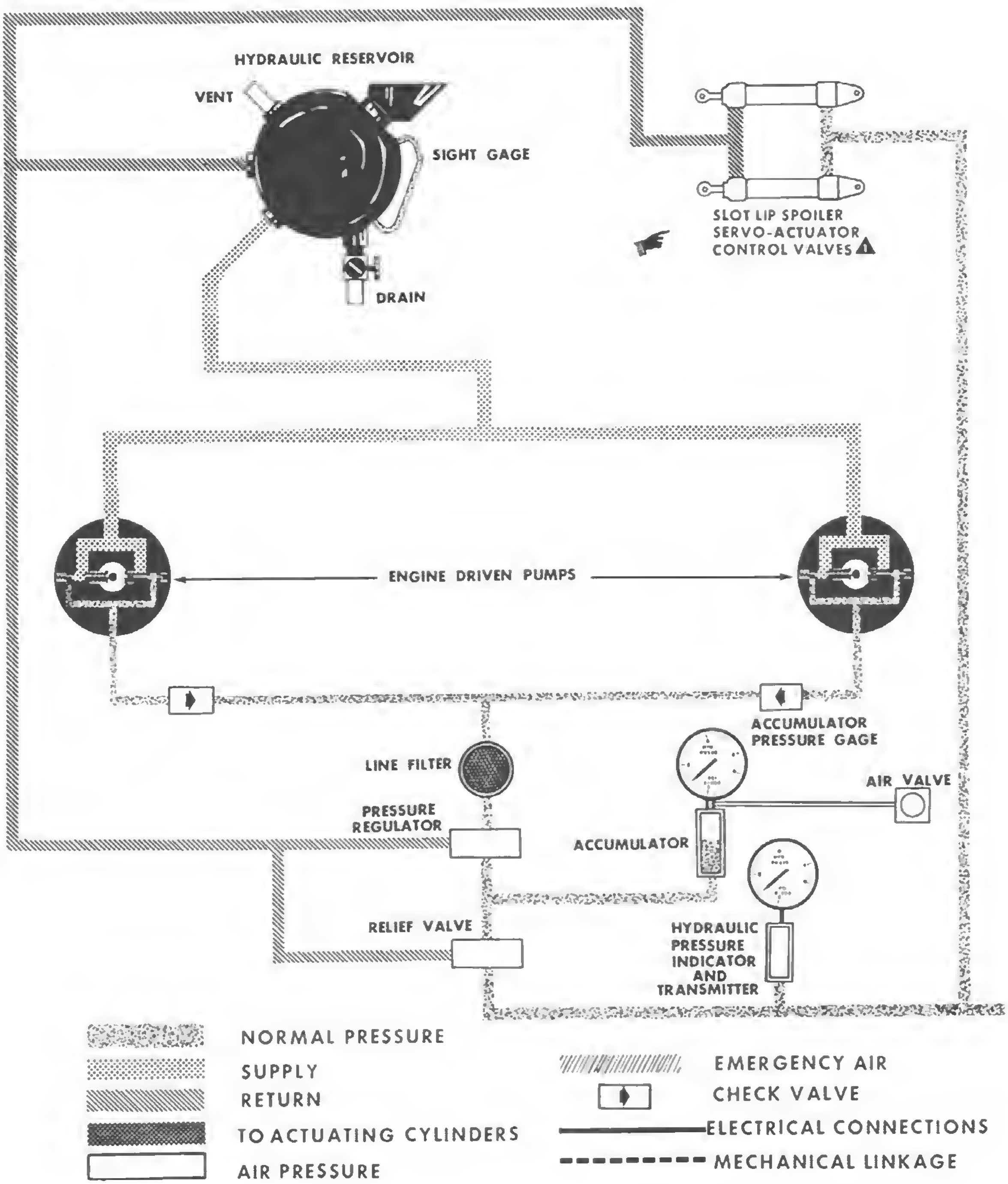
Note

- Pressing to test the light in the fuel shutoff "T" handle only checks the bulb and does not check the fire circuit.
- With an electrical failure the system will also fail. Monitor EGT.

HYDRAULIC POWER SUPPLY SYSTEM

The hydraulic power supply system (figure 1-16) consists of two engine-driven hydraulic pumps, one on each engine. Either pump is capable of maintaining full system pressure with only a slight increase in actuation time. The system supplies power to actuate the hydraulic components of the aircraft. Normal operation of the hydraulic power supply system is automatic when the engines are running. Any sudden surges in the system are absorbed by an air-charged (600 psi) accumulator. A pressure regulator maintains a pressure of 1250 to 1550 psi on the system at all times during operation; however, a pressure relief valve, spring-loaded to relieve at a slightly higher pressure, protects the system in case of regulator failure. An air bottle, located in the nose wheel well is used for emergency landing gear extension in case of hydraulic power failure. See figure 1-51 for hydraulic fluid specification.

HYDRAULIC POWER



▲ AIRCRAFT 68-7975 AND ON AND AIRCRAFT 67-14776 THRU 68-7974 WHEN MODIFIED PER T. O. 1A-37B-530.

Figure 1-16 (Sheet 1 of 2)

SUPPLY SYSTEM

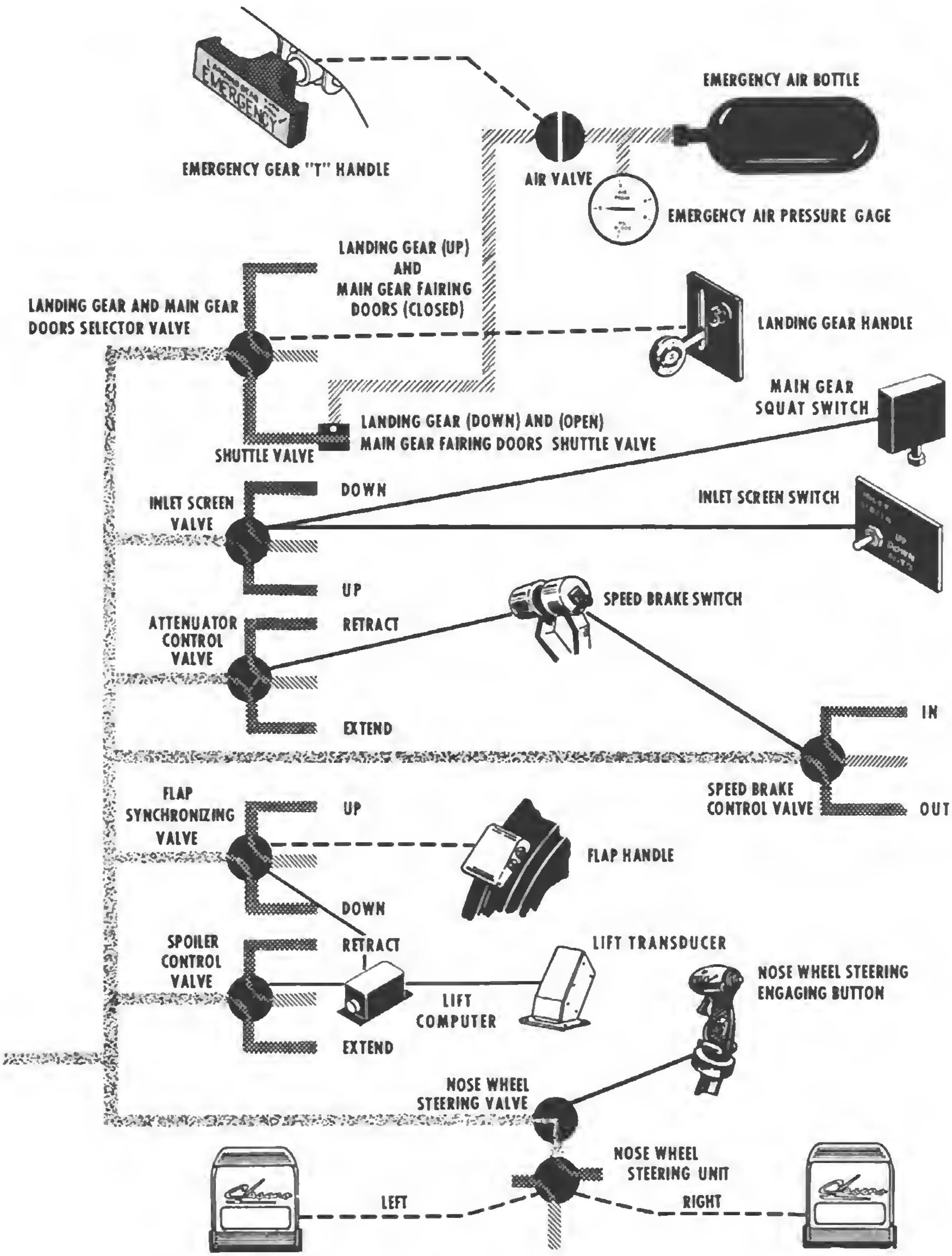


Figure 1-16 (Sheet 2 of 2)

HYDRAULIC SYSTEM PRESSURE INDICATOR

The hydraulic pressure indicator (17, figure 1-4) is a remote indicating instrument, and is operated by the 26 volt single phase 400 cycle ac bus. The indicator indicates hydraulic pressure in pounds per square inch.

LANDING GEAR SYSTEM

The conventional tricycle landing gear is retractable and is powered from the aircraft hydraulic power supply system. The landing gear is controlled mechanically by the landing gear lever (3, figure 1-2). The main gear retracts inboard into the lower surface of the wing, and the nose gear retracts forward into the nose section of the fuselage. Each main gear has two doors: inboard and outboard. The nose gear is faired by split-type doors. The inboard main gear doors are actuated hydraulically and are operated by a sequencing valve in the landing gear system which synchronizes their opening and closing with the extension and retraction of the main gears. They return to the closed position after the landing gear is extended. The inboard main gear doors engage in the uplock hooks, which are hinged to the wing structure and assist in supporting the main gears in the up position. The outboard main gear doors are hinged to the wing and fastened on the bottom to the main gear strut. The nose wheel doors are actuated open and closed by mechanical linkages which are connected to the nose gear. Landing gear and door retraction time is approximately 10 seconds, while extension requires about eight seconds.

LANDING GEAR LEVER

The landing gear lever (3, figure 1-2) is a clear plastic wheel-shaped knob. The lever has two marked positions, UP and DOWN. Positioning the landing gear lever to the UP or DOWN position causes the landing gear to retract or extend. The landing gear lever incorporates a solenoid which holds the lever in the DOWN position as long as the landing gear safety limit switch is de-energized.

LANDING GEAR EMERGENCY OVERRIDE SWITCH

A landing gear emergency override switch (4, figure 1-2) is provided. The purpose of this switch is to supply electrical power to the solenoid lock which holds the landing gear lever in the DOWN position. Pressing the override switch and simultaneously lifting the landing gear lever will allow the landing gear to retract while the weight of the aircraft is on the landing gear providing hydraulic and electrical power are available. The landing gear emergency override switch receives its power from the 28 volt dc bus.

LANDING GEAR POSITION INDICATOR LIGHTS.

There are three landing gear position indicator lights (2, figure 1-4). Each will illuminate when its respective gear is down and locked. Power is supplied by the 28 volt dc bus.

Note

On aircraft ▲, "G" flight maneuver loads may cause the landing gear position indicator lights to indicate an unsafe condition due to hardware tolerances and pressure restrictions in the hydraulic system.

LANDING GEAR WARNING LIGHTS AND AUDIBLE SYSTEM

A red warning light, located in the wheel-shaped knob on the landing gear lever (3, figure 1-2) will illuminate whenever any landing gear is not in a fully locked position and electrical power is available. When a throttle is retarded to approximately 60% ±3% rpm and the gear is not down and locked, the light will be illuminated and the warning signal will send an audio tone to both the pilot and copilots headsets. When the throttles are at idle to 60 ±3% rpm, the warning lights and audible tone can be checked by pressing the test switch (2, figure 1-15). The landing gear audible silencing switch (1, figure 1-2), will silence the warning signal but will automatically be reset each time the retarded throttle(s) is advanced past approximately 60% ±3% rpm. Power to operate the landing gear warning light switch and gear audible warning signal system silencing switch is received from the 28 volt dc bus

LANDING GEAR EMERGENCY EXTENSION SYSTEM

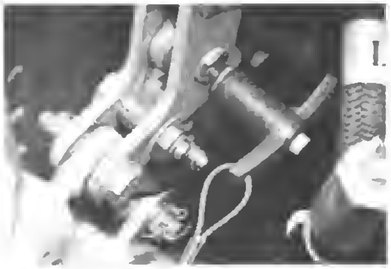
The landing gear emergency extension system consists of an emergency gear "T" handle, located below the TACAN, and emergency air bottle located in the nose compartment. The system contains approximately 2000 ±250 psi of air which is indicated on the pressure gauge near the air bottle. When the landing gear lever is placed in the DOWN position and the emergency gear "T" handle is turned and pulled, air is directed to the shuttle valve and gear lowering hydraulic lines, to open the gear doors and lower the landing gear. When this system is used, no attempt to retract the gear should be made because rupturing of the hydraulic reservoir can result.

NOSE WHEEL STEERING SYSTEM

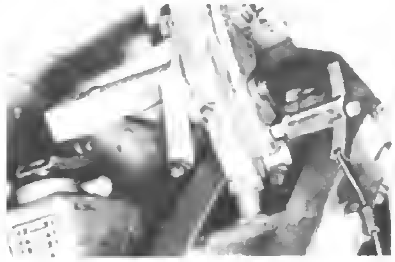
The nose wheel steering system is provided for directional control during taxiing and for portions of the takeoff and landing roll as desired. The system is electrically engaged, and controlled by the rudder pedals, and powered by the hydraulic power supply system. Steering is engaged by a switch on each control stick grip. The hydraulically powered nose wheel steering unit will position the nose wheel within approximately 40 degrees of each side of center when the aircraft is on the ground. The nose wheel can swivel to 50 degrees either side of center when wheel brakes are used. The steer-damper, controlled by rudder pedal movement, directs the hydraulic fluid to an actuator which turns the nose gear strut. The steer-damper device serves two purposes; during power controlled operations it steers

▲ AIRCRAFT 67-14776 THRU 70-1302 EXCEPT WHEN MODIFIED PER T. O. 1A-37-555.

GROUND SAFETY PINS

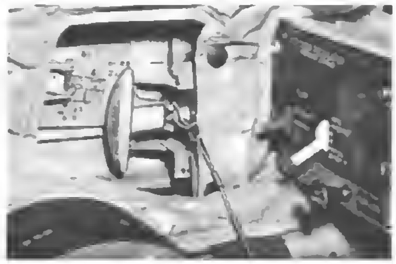


NOSE GEAR



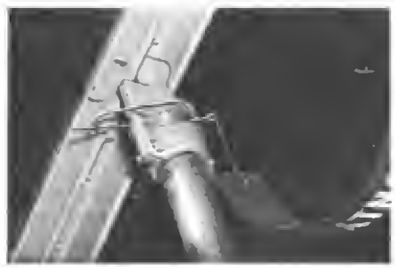
MAIN GEAR

SEAT

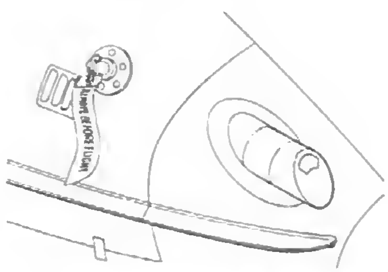


CANOPY JETTISON HANDLE

TRIGGER



CANOPY



NOSE GUN SAFING PIN △6

PYLON

△6 AIRCRAFT 70-1280 AND ON AND AIRCRAFT 67-14776 THRU 70-1279 WHEN MODIFIED PER T. O. 1A-37-523.

Figure 1-17

the nose wheel, and it serves as a shimmy damper with power on or off. Nose wheel steering may be selected at any time while the weight of the aircraft is on the nose wheel, and hydraulic and electrical power is available. The nose gear centering spring centers the nose gear strut during retraction and extension operations. Regardless of the position of the nose gear when the aircraft is on the ground, when the nose gear steering switch is actuated, the nose gear will turn to correspond to the position of the rudder pedals. In the event of a complete hydraulic or electrical failure steering is inoperative. Steering is then accomplished by rudder movement and differential braking. All electrical components used to operate the nose wheel steering mechanisms are powered by current from the 28 volt dc bus.

Note

On aircraft ⚠ nose wheel steering response is very slow at higher gross weights and wheel brakes must be used in conjunction with nose wheel steering to accomplish turns. On aircraft ⚠ nose wheel steering response will be effective and normal at all gross weights.

NOSE WHEEL STEERING BUTTON

When the nose wheel steering button (5, figure 1-20) is depressed and released, power from the 28 volt dc bus actuates a solenoid shutoff valve, which permits hydraulic pressure to be supplied to the nose wheel steering system. To disengage the system the nose wheel steering button must be depressed again and released. A limit switch on the nose gear prevents turning the nose wheel when weight is not on the nose gear.

CAUTION

Continuous depression of the nose wheel steering control switch button is not recommended as this may cause failure of the nose wheel steering system.

Note

The nose wheel steering system is engaged whenever the nose wheel steering button is depressed and held. When the nose wheel steering button is released, the nose wheel steering system will either be engaged or disengaged, depending on the cycle that the system is in.

BRAKE SYSTEM

The brake system is a manually operated independent, hydraulic system set apart from the hydraulic power supply system. The brakes are multi-disc type and are actuated by toe pressure applied to either set of rudder pedals. No emergency braking provisions are provided on the aircraft.

PARKING BRAKE

Setting the brakes is accomplished by applying toe pressure to the rudder pedals and pulling out on the parking brake handle (21, figure 1-2). To release the parking brakes, apply toe pressure to either set of rudder pedals. Aircraft modified by T.O. 1A-37B-549 have the parking brake handle placarded "DEACTIVATED".

WARNING

On aircraft not modified by TCTO 1A-37B-549, "Deactivation of Parking Brake Valve", pilots are cautioned to not apply wheel brakes in flight since the parking brake valve can malfunction resulting in a locked wheels condition during landing.

CAUTION

Use wheel chocks instead of parking brakes whenever possible. Use of the parking brake after heavy braking may cause brakes to lock.

SPEED BRAKE AND THRUST ATTENUATOR SYSTEM

The speed brake and thrust attenuators operate hydraulically through one system using separate control valves. Both control valves are energized open by power from the 28 volt dc bus and are spring-loaded to the closed position.

SPEED BRAKE

The speed brake is located on the bottom side of the nose section just aft of the nose wheel well. The speed brake is hinged at the forward edge and when opened, extends down into the airstream. When retracted, the speed brake closes flush with the fuselage. There are no intermediate opened or closed positions, and there is no position indicator.

SPEED BRAKE SWITCH

Each right engine throttle contains a speed brake switch (5 and 11, figure 1-5), which electrically actuates the speed brake selector valve and the thrust attenuator selector valve. Each speed brake switch is marked IN and OUT with a SOLO override position included in the pilot's switch. The speed brake cannot be extended or retracted by the copilot until the pilot's speed brake switch is positioned to SOLO.

THRUST ATTENUATORS

The function of the thrust attenuator (figure 1-18) is to reduce effective thrust and still maintain a higher

⚠ AIRCRAFT 67-14776 THRU 68-7975 EXCEPT MODIFIED PER T. O. 1A-37B-507.
⚠ AIRCRAFT 68-7976 AND ON, WHEN MODIFIED PER T. O. 1A-37B-507.

THRUST ATTENUATORS

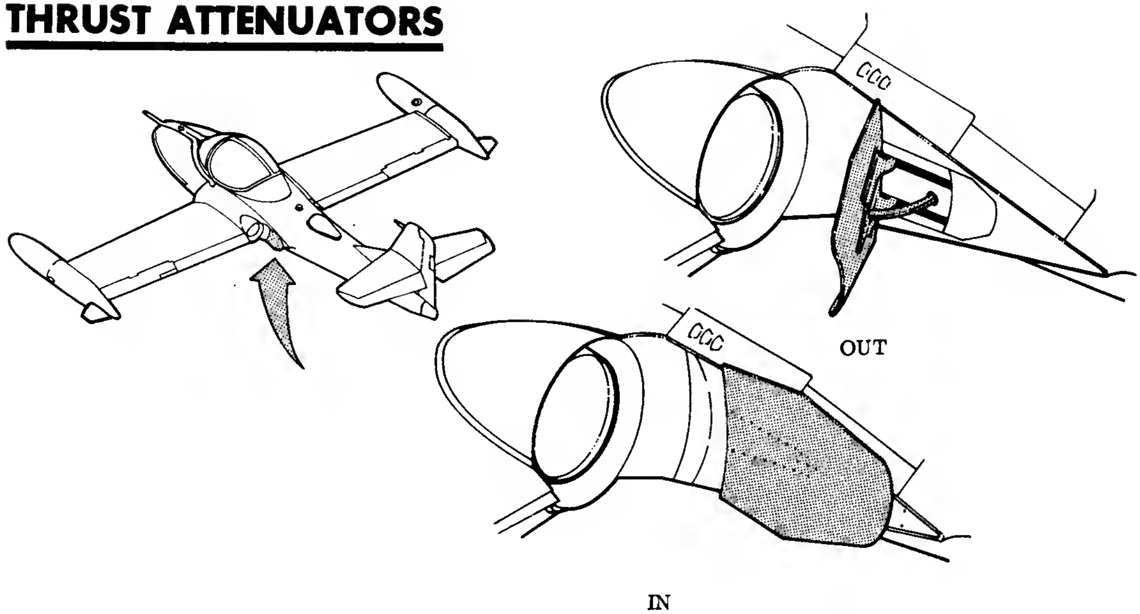


Figure 1-18

SPOILERS

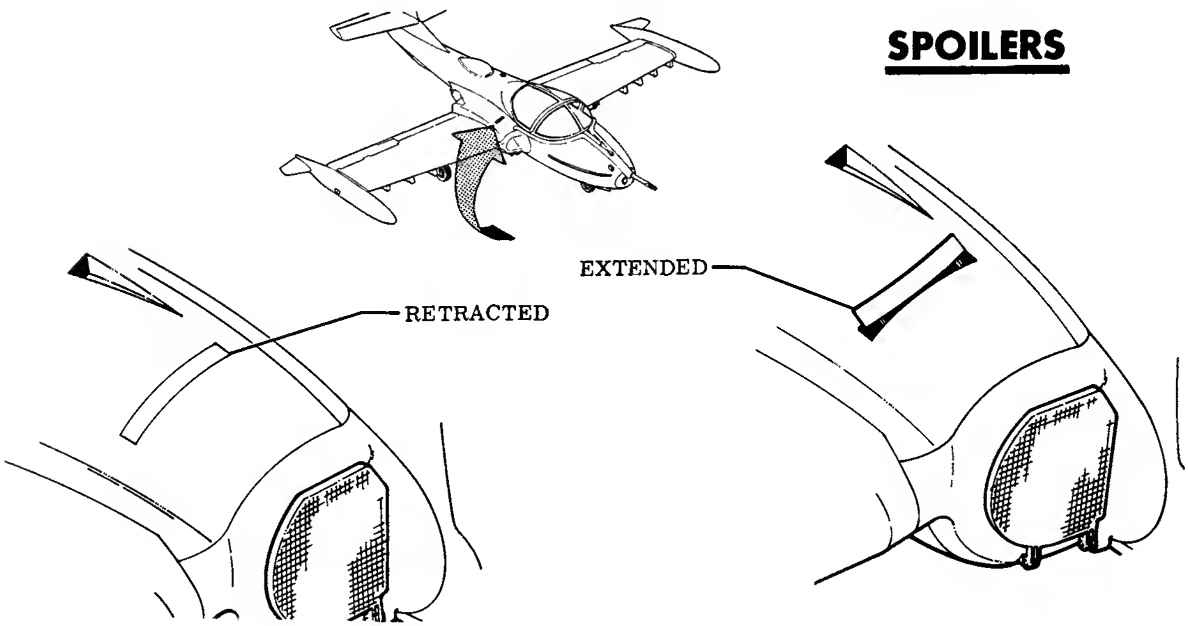


Figure 1-19

engine rpm. The thrust attenuators operate simultaneously with the speed brake when both throttles on both quadrants are between idle and 60 ±3% rpm. The attenuators are primarily used for landing approaches and may also be used to reduce taxi speed.

WING FLAP SYSTEM

The hydraulically operated wing flaps are partial span, slotted, trailing edge type and extend from the aileron to the engine nacelle on each wing. The wing flaps are actuated by wing flap levers to any position. A blow up relief valve in the flap down circuit allows automatic wing flap retraction when the airspeed for flap down configuration is exceeded. In the full down position, the blow up will begin at no less than 145 KIAS and will blow up 10% or more from the full down position at 170 KIAS. A synchronizing unit insures the extension of both flaps at the same rate with a maximum divergence of three degrees.

WING FLAP LEVERS

The wing flap levers (2 and 8, figure 1-5), are labeled Flaps and have three marked positions; UP, ½ and DOWN with a detent at the ½ position. The wing flap levers are mechanically connected to a flap selector valve. The flap selector valve governs the total travel distance of the flap actuating cylinders, permitting a flap down position of any desired setting.

WING FLAP POSITION INDICATOR

Position of the wing flaps is indicated by a 28 volt dc operated wing flap position indicator (5, figure 1-4). The indicator is marked in 10% increments from zero to 100% with 40 degrees of flap extension being 100% deflection.

SPOILER SYSTEM

The purpose of the spoilers (figure 1-19) is to provide sufficient stall warning for configurations with the flaps extended. The spoiler extension speed is adjusted to extend at 10 ±1 KIAS above stall at any gross weight. They will extend at 88 KIAS when the aircraft internal fuel is approximately 1200 pounds, with gear, flaps and speed brake down, and power set at 72% rpm. A transducer vane located on the left nacelle is connected electrically to the spoiler system, when approximately 25% of flaps are extended, and activates the hydraulically operated spoilers to the extended position when a critical angle-of-attack is approached. When extended, the spoilers create a turbulent airflow which is felt as a buffet at 10 ±1 KIAS above stall. The spoiler extension speeds wiil vary through the aircraft's gross weight range, and increase in proportion with higher angles of bank and accelerated flight.

SLOT LIP SPOILERS ▲

The slot lip spoilers, located forward of the leading edge of the flaps, provide a marked increase in roll rates at all gross weights and airspeeds. The spoilers are hydraulically actuated and operate in conjunction with the ailerons. As the ailerons deflect upward, the spoilers raise in proportion to the amount of aileron deflection, thereby negating the lift and increasing the roll rate. When the ailerons are in a neutral or downward deflected position, the slot lip spoilers remain in the retracted position. Servo-actuator control valves are linked to the respective aileron cable system so that spoiler deflection is proportional to stick deflection, with a small dead-band at neutral. These servo-actuators provide no feed back, and thereby give essentially the same aileron stick force as an A-37 without slot lip spoilers.

▲ AIRCRAFT 68-7975 AND ON AND
AIRCRAFT 67-14776 THRU 68-7974
WHEN MODIFIED PER T. O. 1A-37B-530.

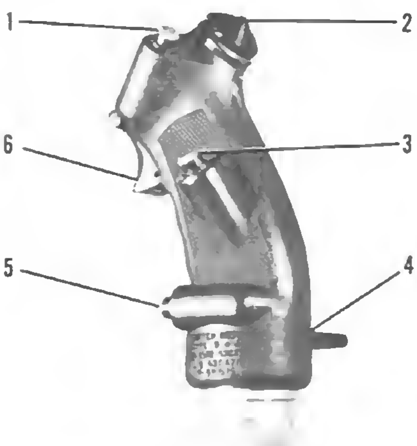
FLIGHT CONTROL SYSTEM

The flight control system comprises two groups of control surfaces, primary and secondary. The primary control surface group includes ailerons, elevators, and rudder. The secondary control surface group includes trim tabs on the left aileron, left elevator and rudder, and boost tabs on right and left ailerons for better roll control. The function of the primary control surface group is to provide control of the aircraft. All of the primary control surfaces are manually operated, through a system of cables, pulleys, bellcranks, and push-pull rods. The elevator cables are redundant in nature, giving the additional safety factor of dual cables. The function of the secondary control surface group is to provide an aerodynamic control for the surface to which they are attached and serves to hold that surface at a position that will result in a balancing or trimming of the aircraft for any normal attitude of flight. All of the tabs are electrically operated and are controllable from the cockpit.

AILERON BOOST TABS

The force sensitive aileron boost tabs are connected to the aileron control system by means of two pre-loaded torsion bars. The torsion bars provide for normal aileron operation until the aileron aerodynamic forces overcome the preload; at this point the torsion bars will flex allowing a push rod to deflect the boost tab in the direction opposite to aileron deflection. The opposite deflection of the boost tab acts as a control boost for the aileron.

CONTROL STICK GRIP



1. BOMB/ROCKET BUTTON
2. ELEVATOR AND AILERON TRIM SWITCH
3. YAW DAMPER DISCONNECT SWITCH
4. HANDREST
5. NOSE WHEEL STEERING BUTTON
6. TRIGGER

Figure 1-20

CONTROL STICK GRIP

Aileron and elevator control is maintained by dual control sticks on indivtdual yokes, interconnected to permit control of the aircraft uslng either control stick. Each control stick has a typical fighter-type control stick grip (figure 1-20), which incorporates the aileron and elevator trim switch, nose wheel steering button trtgger, bomb/rocket button and yaw damper disconnect button. All are operative on the pilots stick grip. On the copilots stick grip only the aileron and elevator trim switch and nose wheel steering button are operative.

RUDDER PEDALS

Fore and aft movement on the rudder pedals controls the rudder position through mechanical linkage; toe pressure on the pedals operate the brakes. Each set of pedals is equipped wtth rudder pedal adjustment (4, figure 1-21).

AILERON AND ELEVATOR TRIM TAB SWITCH

Normal trim of the aileron and elevator trim tab is provided through a five position, momentary toggle-type, atleron and elevator trlm tab switch (2, figure 1-20). The switch receives its power from the 28 volt dc bus, and is spring-loaded to the center off positlon. Movlng the trlm tab swltch to the left or to the right actuates the aileron trim motor. The motor is geared down and actuates a push-pull rod which in turn positions the aileron trim tab up or down - depending on which direction the switch was positioned. Pushing the switch forward or aft actuates the elevator trim tab motor. The elevator trtm tab motor positions the elevator trim tab to the desired up or down position through a screwjack arrangement.

WARNING

To avoid any possiblity of overtrim in the event of limit switch malfunction, the atleron and elevator trim tab switch should be manually returned to the OFF position.

ADJUSTABLE BOB WEIGHT

An adjustable bob weight is provided in the flight control system to harmonize stick forces and make the elevator stick force the same as the aileron for the various stores configurations of the aircraft. The bob weight is located just forward of the copilots control stick. A viewing window is provided for checking the position of the bob weight. The bob weight has three positions for Heavy, Normal and Light stick forces. Once the bob weight has been set on the ground there is no need to change it again until the next flight. The Heavy position is full clockwlse rotation of the crank to the stop. Thts position is only used with four pylon tanks regardless of other stores loaded on the aircraft. The Normal position is tn the center when the scribe is aligned with the centering mark on the shaft. This position is used in all normal flights and loadings.

The Light position is full counterclockwise rotation of the crank to the stop. This position is used with four M117 GP bombs regardless of other stores loaded on the atrcraft.

The pilot has a visual check, through the window and a feel check, by elevator movement force, on the ground as to the position of the bob weight. The bob

weight will provide normal in-flight stick forces for the elevator control when the two extreme conditions are encountered.

CAUTION

- The bob weight should be checked and if necessary adjusted on preflight.
- When cranking the bob weight to full clockwise or full counterclockwise to the stop, do not force the crank once the stop has been reached. Damage to the stop can result from unnecessary force.
- When set insure that crank is safety wired prior to flight.

ELEVATOR TAKEOFF TRIM INDICATOR LIGHT

The elevator takeoff trim indicator light (2, figure 1-14), on the annunciator panel will illuminate when the elevator tab is in the neutral position, and the battery switch is ON. The light receives its power from the 28 volt dc bus.

RUDDER TRIM TAB SWITCH

The rudder trim tab is electrically controlled through a switch (7, figure 1-5 and 14, figure 1-6), mounted horizontally on the aft side of the pilot's quadrant. The switch is held to LEFT or RIGHT corresponding rudder trim and spring-loaded to the OFF position. The rudder trim tab switch receives its power from the 28 volt dc bus.

RUDDER TRIM NEUTRAL INDICATOR LIGHT

The rudder trim neutral indicator light (21, figure 1-14), on the annunciator panel will illuminate when the rudder tab is in the neutral position, and the battery switch is ON. The light receives its power from the 28 volt dc bus.

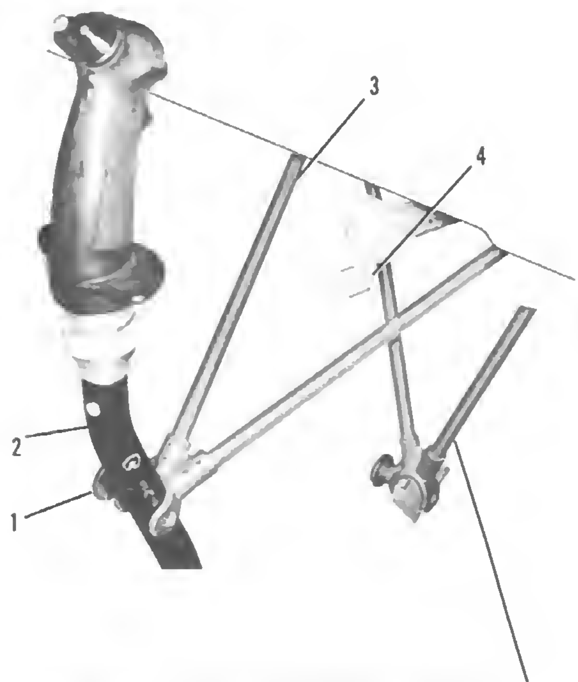
CONTROL LOCK

Primary flight control surfaces can be locked in the neutral position by a control lock (figure 1-21), below the instrument panel on the pilot's side. When the control lock is rotated up and is attached to the control stick, all surface controls are locked in neutral and the throttles are locked in the IDLE thru CUT-OFF range.

YAW DAMPER SYSTEM

The yaw damper system controls the yaw oscillations of the aircraft, and increases the stability of the aircraft about its yaw axis. The yaw damper system is electrically controlled and pneumatically actuated. The yaw damper servo functions in response to signals from the computer which obtains its information from the yaw rate gyro. The yaw damper servo, connected differentially through bellows to the rudder control system, controls the rudder in response to yaw signals initiated by the yaw rate gyro. The bellows are actuated pneumatically and utilize engine bleed air for operation. The yaw damper system can be overridden by moving the rudder pedals to provide an intentional sideslip. The yaw damper system is controlled by the pilot operated yaw damper power switch located on the switch panel, (4, figure 1-6). It provides control response with corresponding movement of the rudder pedals. The switch is a two-position OFF-ON switch. Placing the switch in the ON position provides power to the yaw damper system and places it in operation; placing the switch in the OFF position disconnects all power and leaves the system inoperative, a yaw damper disconnect switch is provided on the control stick grip (3, figure 1-20) to disconnect the yaw damper system at anytime. To return to yaw damper operation, the OFF-ON switch must be placed in the ON position. The system receives its power from the 28 volt dc bus and is protected by a circuit breaker.

CONTROL LOCK



1. PULL PIN
2. CONTROL STICK
3. CONTROL LOCK
4. RUDDER PEDAL ADJUSTMENT

Figure 1-21

PITOT AND STALL WARNING TRANSDUCER VANE HEAT

PITOT HEAT SWITCH

The pitot tube, located in the leading edge of the vertical stabilizer and the stall warning transducer vane located in the left wing nacelle area, are heated by power from the 28 volt dc bus which is controlled by a pitot heat switch (20, figure 1-6). The switch has two positions, ON and OFF.

INSTRUMENTS

The flight and engine instruments are mounted on the left instrument panel (figure 1-4). An altimeter, turn and slip indicator, airspeed indicator and stand-by attitude gyro, are also mounted on the right instrument and ac fuse panel (figure 1-11).

ACCELEROMETER

An accelerometer, to measure and record positive and negative acceleration ("G") loads is mounted on the cockpit instrument panel (13, figure 1-4). The indicator has three movable pointers. One pointer moves in the direction of the "G" load being applied, while the other two (one for positive "G", and one for negative "G") follow the indicator pointer to its maximum travel. These recording pointers remain at their respective maximum travel position of the "G" load being applied. Depressing a PUSH TO SET button, in the lower left corner of the instrument, will allow the recording pointers to return to the one "G" position.

MM-3 ATTITUDE INDICATOR

The aircraft is equipped with an MM-3 attitude indicator (14, figure 1-4) which displays information received from an MD-1 remote gyro control assembly. The MM-3 displays precise attitude information through 360° bank and ±82° of pitch.

Note

> At approximately 82° of pitch, the attitude sphere will rotate 180°. This momentary rotation is known as controlled precession and should not be confused with gyro tumbling. After the rotation is complete, the pitch and roll indications will be accurate except for a small amount of precession. After straight and level flight is resumed, this precession will be corrected at the rate of .8 to 1.8° per minute.

The attitude sphere of the MM-3 is divided by a white horizon bar which provides a sensitive pitch reference near a level flight attitude. The top, or "sky" half of the sphere is colored light gray and the lower or "ground" half is black. A pitch reference scale indicates pitch angle through 90° climb or dive. These pitch lines are graduated at 5° intervals with numerical indications at 30° and 60° of pitch. The words "climb" and "dive" are depicted on the sphere at 15°.

Bank attitude is indicated by the position of the bank pointer in relation to the fixed bank scale which is marked at 0, 10, 20, 30, 60, and 90°

An attitude warning symbol placarded OFF will be visible for one minute ±10 seconds after power is applied to the instrument or any time the instrument is not receiving proper electrical power. In either case, the instrument is unreliable until the warning symbol is not visible.

WARNING

> The attitude warning symbol will not be visible with a slight electrical power reduction or failure of other components within the system. This can result in erroneous or complete loss of pitch and bank presentations without the warning symbol appearing. Therefore, other flight instruments, and the stand-by attitude indicator should be cross-checked to insure accuracy of the MM-3 attitude indicator.

The pitch trim knob electrically positions the attitude sphere to provide desired pitch presentations relative to the fixed miniature aircraft.

Turn, acceleration, and deceleration errors have been virtually eliminated in the MM-3 attitude indicator. Acceleration error during takeoff will be the most noticeable error and will appear as a climb indication error of approximately $1\frac{1}{2}°$ just prior to breaking ground. The exact amount of error will depend upon the duration of acceleration. The system is powered by the 115 volt ac three phase bus; refer to figure 1-12

MM-3 Attitude Indicator Fast Erection Switch

The MM-3 attitude indicator fast erection switch (9, figure 1-4) provides fast erection for the MM-3 system. The switch has two positions, NORMAL and FAST, and is spring-loaded to the NORMAL position. When the switch is held to the FAST position, gyro erection is at a rate of 20 degrees per minute.

CAUTION

> To avoid damage to the internal components of the MM-3 attitude indicator system, the fast erection switch should not be held in the FAST position longer than two minutes, and an allowance of five minutes between each use should be observed.

STAND-BY ATTITUDE INDICATOR

The stand-by attitude indicator on the right instrument panel is a self contained unit. It is installed to provide an alternate system in the event of malfunction or failure of the vertical gyro attitude indicator. A power warning flag, marked OFF, will appear in the face of the indicator when power is removed or when the indicator gyroscope is caged. Clockwise rotation of the caging knob when fully extended locks the gyro. Rotation of the caging knob when retracted adjusts the position of the miniature airplane to a minimum of five degrees in climb or dive. The drum has 360 degrees freedom of movement in the roll axis with index marks at 10, 20, 30, 60 and 90 degrees. The drum has freedom to display 85 degrees in climb and 85 degrees in dive with graduated 5 degree dive and climb markings. The attitude drum is divided by a white horizon bar which provides reference near level flight attitude. The top or "sky" half of the drum is white and the lower or "ground" half is black. The system is powered by the 115 volt ac three phase bus.

CAUTION

Do not fly with the stand-by attitude indicator in the locked caged position or damage to the gyro mechanism may occur.

To operate the indicator, pull the caging knob and rotate full clockwise to the locked position prior to applying aircraft power. Retract the caging knob a minimum of three minutes after power application. The indicator will stabilize to vertical within a maximum of three minutes after the caging knob is released. Adjust the pitch trim knob clockwise or counterclockwise to obtain the desired pitch presentation. Clockwise rotation moves the miniature airplane upward five degrees and counterclockwise rotation moves the miniature airplane downward five degrees.

The rate of gyro self errection is 2.5 degree/min in level flight and 0.8 degrees/min during turns and fore/aft acceleration.

Manual caging is provided for fast reliable alignment. In the event of an unusually large pitch indication error due to severe maneuvering, the aircraft should be brought to level flight and the indicator gyroscope should be momentarily caged. The indicator will stabilize to vertical within a maximum of three minutes after the caging knob is released.

WARNING

When the power warning flag appears, the attitude information is only usable for up to nine minutes. Therefore, the barametric flight instruments should be cross-checked to assure accuracy.

An attitude warning flag will be visible anytime the instrument is not receiving proper electrical power or failure of any electrical components within the indicator occurs. After the flag appears, the indicator will still provide usable attitude information (±5 degrees pitch/bank) for a minimum of nine minutes after removal of power. The system is powered by the 115 volt ac three phase bus.

AAU-8/A ALTIMETER ⚠1

An AAU-8/A altimeter is located on the left (25, figure 1-4) and right (5, figure 1-11) instrument panels. The AAU-8/A altimeter is a conventional pitot-static air pressure activated altimeter. The altimeter has a range of 50, 000 feet.

AAU-21/A ALTIMETER ENCODER ⚠2

An AAU-21/A altimeter (25A, figure 1-4) is located on the left instrument panel. The AAU-21/A altimeter is a pitot-static instrument with an electrically operated altitude-reporting encoder. The altitude-reporting encoder furnishes altitude information to the AN/APX-72 IFF system for transmission to a station appropriately equipped to interrogate. When power to the encoder is off, a CODE OFF flag is visable indicating that altitude information is not being transmitted to the AN/APX-72 IFF system. In this condition, the instrument continues to function as a normal altimeter. When power is applied to the encoder the CODE OFF flag retracts from view. The AAU-21/A altimeter encoder has a range of -1000 to +38, 000 feet. The system is powered by the 28 volt dc bus.

⚠1 AIRCRAFT 67-14776 THRU 69-6417, 69-6436 AND 69-6444 THRU 69-6446 EXCEPT WHEN MODIFIED PER T. O. 1A-37B-506.

⚠2 AIRCRAFT 69-6418 THRU 69-6435, 69-6437 THRU 69-6443, 70-1277 AND ON AND AIRCRAFT 68-7911, 68-7912, 68-7927 THRU 68-7948, 68-7950 THRU 68-7974, 68-10811 THRU 68-10814, 68-10819 THRU 68-10827, 69-6363 THRU 69-6371 AND 69-6378 THRU 69-6399 WHEN MODIFIED PER T. O. 1A-37B-506.

(BDHI) HEADING INDICATOR

The heading indicator (10, figure 1-4 and figure 1-36) consists of a directional gyro that is automatically kept on the magnetic heading of the aircraft by a flux valve located in the horizontal stabilizer. Electrical power for the heading indicator J-2 system is supplied by the 28 volt dc bus and the 115 volt ac three phase bus; refer to figure 1-12. For the first two or three minutes of operation, the gyro is on a fast slaving cycle, during which it reaches operating speed and aligns with the magnetic heading of the aircraft. Then the gyro begins a slow slaving cycle.

Note

- Should either the dc or ac power supply fail, the heading indicator J-2 system is automatically disconnected from all electrical power.
- After the gyro reaches operating speed, observe the indicator and compare the indication with the actual heading of the aircraft by the indication of the magnetic compass. If the difference is over 5°, the heading indicator is not operating properly and should be checked for malfunction.

Compass Slaving Switch

The switch (8, figure 1-4) has three positions, OUT, IN and FAST. When the switch is in the IN position, electrical power is supplied to the transmitter and the system operates as a slaved gyro heading indicator. Except for special circumstances, the switch should always be in the IN position. With the switch in the FAST position, it provides a means of stabilizing the gyro after it has been upset by overbanking or acrobatics. Holding the switch in FAST interrupts 28 volt dc power to the amplifier. When the switch is released, it will return to the IN position, and power will be restored and the fast slaving cycle is initiated to permit faster gyro recovery to the true heading. With the switch in the OUT position, the magnetic function of the heading indicator is discontinued by shutting off the power supply to the slaving torque motor. The OUT position of the switch is designed to navigate in polar areas where the excessive dip of the earth's magnetic field causes indications to become inaccurate. The heading indicator may still be used for a relatively accurate indication of heading change during turns.

CAUTION

- Since there is no means of resetting the reading to correct for gyro precession, the heading indicator should not be used for heading information when the compass slaving switch is in the OUT position.
- To avoid damage to the slaving torque motor, the switch should not be positioned to the FAST position too frequently. Allow 10 minutes between actuations, and hold switch no longer than two seconds.

STAND-BY MAGNETIC COMPASS

The stand-by magnetic compass (10, figure 1-2) can be used in the event of malfunctions of the heading indicator system. It requires no outside power source except for lighting of the instrument. A compass correction card below the right instrument panel (6, figure 1-11) indicates deviation in the system.

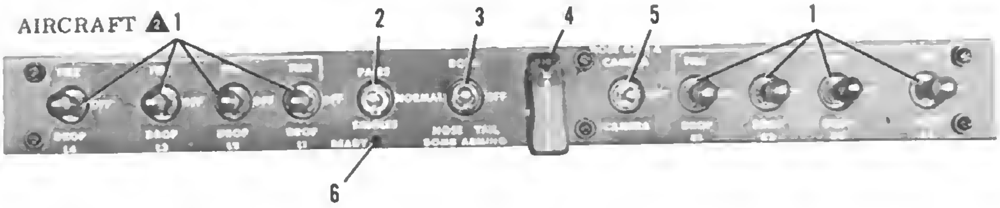
Compass Light Switch

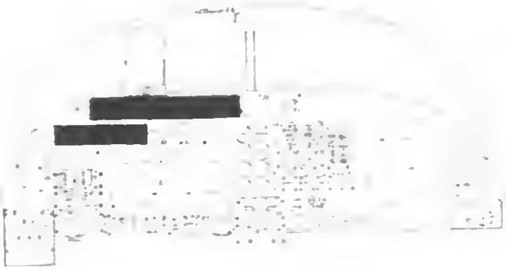
The compass light switch at the left of the compass is a two-position switch. In the ON position, light is provided for compass illumination. In the OFF position, 28 volt dc power is disconnected.

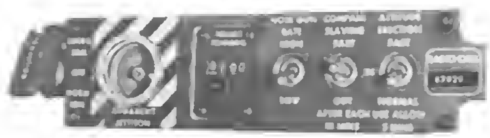
CLOCK

The clock (15, figure 1-4) contains an elapsed-time mechanism which uses a sweep-second hand and a minute totalizer. The elapsed-time mechanism is started, stopped, and reset by pushing in on the control knob located at the upper right-hand corner of the clock face.

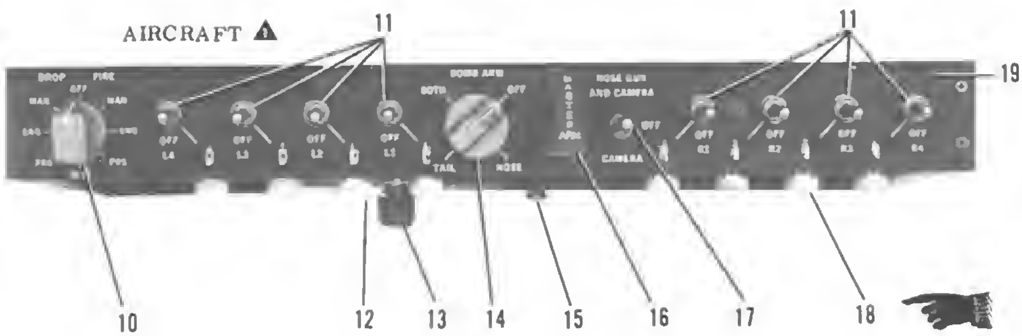
ARMAMENT PANEL







1. PYLON FUNCTION SWITCHES
2. SEQUENCE SWITCH
3. BOMB ARMING SWITCH
4. MASTER ARMAMENT SWITCH
5. NOSE GUN & CAMERA SWITCH
6. SEQUENCE READY LIGHT
7. NOSE GUN RATE SWITCH
8. ROUNDS REMAINING COUNTER
9. ARMAMENT JETTISON BUTTON



10. MODE SELECTOR SWITCH
11. PYLON FUNCTION SWITCHES (8)
12. MEMORY RESET SWITCH
13. READY LIGHTS DIMMING SWITCH
14. BOMB ARM SWITCH
15. NOSE CAMERA CIRCUIT BREAKER
16. MASTER ARM SWITCH
17. NOSE GUN AND CAMERA SWITCH
18. PYLON PROGRAM SWITCHES (8)
19. READY LIGHTS (8)

1 AIRCRAFT 68-7974 AND ON AND AIRCRAFT 67-14776 THRU 68-7973 WHEN MODIFIED PER T. O. 1A-37B-504.

2 AIRCRAFT 67-14776 THRU 68-7973 EXCEPT AIRCRAFT MODIFIED PER T. O. 1A-37B-504.

Figure 1-22

TURN AND SLIP INDICATOR

The turn and slip indicator (16, figure 1-4) receives power from the 28 volt dc bus. The indicator is operational whenever dc power is applied to the aircraft.

PITOT STATIC INSTRUMENTS

Five flight instruments operate from the pitot static system. They are the two airspeed indicators (26, figure 1-4 and 2, figure 1-11), two altimeters (25, 25A, figure 1-4 and 5, figure 1-11) and a vertical velocity indicator (23, figure 1-4).

ARMAMENT EQUIPMENT

The basic armament equipment consists of a 7.62mm nose mounted minigun; four armament pylons, located on the underside of each wing; a gunsight system, installed directly in front of the pilot on the instrument panel glare shield; a gun camera in the nose; and provisions for a strike camera or reconnaissance camera in the fuselage belly. The armament pylons have provisions for attaching fuel tanks and/or munitions.

MASTER ARMAMENT PANEL

The master armament panel, located below the optical sight, contains the armament control switches. The lower portion of the panel contains the nose camera circuit breaker and a memory reset switch. The armament system receives its power from the 28 volt dc bus. A nose gear safety switch serves as an armament safety switch to de-energize all normal armament circuits when the landing gear shock struts are compressed by the weight of the aircraft.

ARMAMENT RELAY CIRCUIT 2

Armament relay circuits control application of power to the arming circuits when the trigger or bomb/rocket button is depressed. Four armament circuit breakers (figure 1-11), located forward of the pilot's control quadrant, protect the armament relay circuits.

ARMAMENT CONTROLS 1

Master Armament Switch

A master armament switch (16, figure 1-22), located in the center of the master armament panel, controls armament operation. The switch, marked MASTER ARM, is guard covered and has two positions, ON and OFF. The master armament switch receives its power from the 28 volt dc bus and is protected by a current limiting resistor. When the master armament switch is placed in the ON position, a relay is closed allowing power to be connected to the rest of the armament switches. Each switch is protected by a current limiting resistor. When the cover is closed, the switch is returned to OFF, and power is disconnected from the master armament panel, with the exception of the camera circuit.

CAUTION

The master armament switch must be positioned OFF at all times, except when actually ready to activate the armament circuit.

Nose Gun and Camera Switch

The three position, nose gun and camera switch (17, figure 1-22), is placarded NOSE GUN AND CAMERA, OFF and CAMERA. In the NOSE GUN AND CAMERA position, with the master arm switch ON, the gun camera will be actuated when the trigger is depressed to the first detent. When the trigger is pressed to the second detent, the camera continues to run and the nose gun starts firing. In the OFF position, no power is provided to the nose gun or camera circuit. In the CAMERA position, with the master arm switch ON or OFF, the gun camera will operate when the trigger is depressed to the first or second detent.

The nose camera circuit is protected by a circuit breaker (15, figure 1-22) located on the bottom center of the chassis just forward of the armament panel face.

Pylon Program Switches

The pylon program switches are five position, horizontally mounted, rotary switches located below the applicable pylon function switches and are placarded: FS (Fire Single), FR (Fire Ripple), DP (Bomb), GN (Gun), and EM (Empty Pylon or Pylon Tank). One of these symbols will be visible in the pylon program window at all times. The pylon program switches are preset by the loading crew for the type of ordnance installed. The pilot should verify the correct positioning of the pylon program switches after stores loading. With correct positioning of the pylon program switches, a gun pod or pylon tank cannot be dropped regardless of pylon function or mode selector switch position.

Pylon Function Switches

The pylon function switches (11, figure 1-22) are two position, toggle switches placarded READY and OFF. When the switches are placed in the READY position, and the applicable ready lights are illuminated, the selected store will be deployed as programmed. In the OFF position, no power is available to the pylon. All eight switches are energized by the MASTER ARM switch. The left wing bank of four switches, placarded L1, L2, L3 and L4 from inboard to outboard, direct electrical power to the four left wing pylons. The right wing bank of four switches, placarded R1, R2, R3 and R4 from inboard to outboard, direct electrical power to the four right wing pylons.

1 AIRCRAFT 68-7974 AND ON AND AIRCRAFT 67-14776 THRU 68-7973 WHEN MODIFIED PER T.O. 1A-37B-504.

2 AIRCRAFT 71-790 AND ON AND AIRCRAFT 67-14776 THRU 70-1312 WHEN MODIFIED PER T.O. 1A-37B-552.

Ready Lights

Eight ready lights (19, figure 1-22), one for each pylon, illuminate when a pylon is properly programmed. If a ready light is not illuminated, the pylon is either not properly programmed or a malfunction exists. If a light bulb failure is suspected, the ready lights can be tested by pressing the TEST WARNING LIGHTS switch located to the right of the fuel shutoff T-handles.

Mode Selector Switch

WARNING

Never rotate the mode selector switch unless master arm switch is off. Since this switch is an integral part of the armament panel logic, under certain conditions it is possible to release ordnance when the mode selector switch is in an intermediate position.

The mode selector switch (10, figure 1-22), located on the master armament panel, allows the selection of one of three basic modes: DROP, FIRE or JETT.

The DROP mode is selected only when bombs are to be dropped. The DROP mode is further divided into MAN (Manual), SNG (Single), and PRS (Pairs). In the DROP MAN position, with the applicable ready lights illuminated, the selected pylons will drop their bombs simultaneously when the bomb/rocket button is pressed. In the DROP SNG position, with the applicable ready lights illuminated, the drop sequence begins with L4 then R4 and proceeds inboard alternately on each wing actuating the selected pylons at each depression of the bomb/rocket button. In the DROP PRS position, the pylons will be actuated from outboard to inboard in pairs (L4/R4, L3/R3, etc.) with each depression of the bomb/rocket button. If an incompatible pair is encountered, such as a gun pod on L3 and a bomb on R3, that pair will be passed and the next inboard compatible pair will be actuated. Only matched pairs will be deployed.

The FIRE mode is selected when rockets or gun pods are to be fired. This mode is divided into MAN (Manual), SNG (Single), and PRS (Pairs). In the FIRE MAN position, with the applicable ready lights illuminated, the selected pylons will fire the ordnance simultaneously when the bomb/rocket button is pressed. In the FIRE SNG position, with the applicable ready lights illuminated, the fire sequence begins with L4 then R4 and proceeds inboard alternately on each wing, actuating the selected pylons with each depression of the bomb/rocket button. In the FIRE PRS position, with the applicable ready lights illuminated, the fire sequence will be outboard to inboard in pairs (L4/R4, L3/R3, etc.) with each depression of the bomb/rocket button.

The JETT (Selective Jettison) position is selected by pulling out and rotating the mode selector to JETT. This position provides simultaneous jettison of all selected and ready pylons when the bomb/rocket button is pressed. The selective jettison will not release pylon tanks or gun pods. The ready lights will flash on all ready pylons when the JETT mode is selected. In this mode, bombs will be dropped armed in accordance with the bomb arming switch position.

Bomb Arm Switch

The bomb arm switch (14, figure 1-22), located on the master armament panel, allows the selection of one of four positions, TAIL, NOSE, BOTH or OFF. With the OFF position selected, the applicable ready lights will not be illuminated; therefore, no stores will be deployed. With the TAIL position selected and the applicable ready lights illuminated, the bombs will be released with the tail fuzes armed. With the NOSE position selected and the applicable ready lights illuminated, the bombs will be released with the nose fuzes armed. With the BOTH position selected and the applicable ready lights illuminated, the bombs will be released with the nose and tail fuzes armed.

Memory Function

The memory function of the armament panel informs the pilot of the availability and readiness to deploy munitions. The memory function is determined by the munitions which the loading crew loads on the aircraft. The memory circuit is operative when the mode selector is in any DROP mode. When the mode selector is in a FIRE mode, the memory is operative only when the applicable pylon program switches are placed to FR. When a pylon is selected which is empty or the ordnance has already been deployed, the pylon is considered empty and the ready light will not illuminate.

Memory Reset Switch.

Note

Prior to turning the Master Armament Switch On for first stores release, the memory reset switch must be depressed to insure the memory function is in the proper condition for stores release. After depressing the memory reset switch, prior to first stores release, the pilot SHALL NOT depress the memory reset switch again.

The memory reset switch (12, figure 1-22), located on the bottom of the master armament panel, provides the pilot with the ability to clear the memory function of any knowledge that munitions have been deployed. When the memory reset switch is depressed and released, the memory function will return to

the state normally experienced prior to deployment of any munitions. The ready lights will then indicate that the full munitions condition exists. There will be no indication on the armament panel of any munitions having been deployed.

MASTER ARMAMENT PANEL ▲ AIRCRAFT

The master armament panel located below the sight contains the armament control switches. The lower portion of the panel contains the circuit breakers for the armament system. The armament system receives its power from the 28 volt dc bus. A nose gear safety switch serves as an armament safety switch to de-energize all normal armament circuits when the landing gear shock struts are compressed by the weight of the aircraft.

ARMAMENT CONTROLS ▲ AIRCRAFT

Master Armament Switch

CAUTION

The master armament switch must be positioned OFF at all times, except when actually ready to activate the armament circuit.

A guarded master armament switch (4, figure 1-22) located in the center on the master armament panel, is used to control armament operation. The switch is marked MASTER ARM, is guard covered and has two positions, ON and OFF. The master armament switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11). When the master armament switch is placed in the ON position (cover raised) a relay is closed allowing 28 volt dc power to be connected to the rest of the armament switches. Each switch is protected by a circuit breaker on the lower portion of the master armament panel. With the cover closed the switch is returned to OFF, and all 28 volts dc power is disconnected from the master armament panel.

▲ AIRCRAFT 67-14776 THRU 68-7973 EXCEPT AIRCRAFT MODIFIED PER T.O. 1A-37B-504.

Nose Gun and Camera Switch

The nose gun and camera switch (5, figure 1-22) is a three-position switch. In the NOSE GUN & CAMERA position, 28 volt dc power is provided for operation of the gun and camera. In the CAMERA position, only power to the camera is provided. The trigger must be closed in either case to complete the 28 volt dc circuit. In the OFF position, power is disconnected from both systems.

SEQUENCING SWITCH ▲ AIRCRAFT

WARNING

> The sequencing switch will remain NORMAL at all times.

The fire control sequencing switch (2, figure 1-22) is a three-position switch labeled NORMAL, SINGLES, and PAIRS. The power is provided to the switch by the 28 volt dc armament bus. With a properly programmed sequence and the sequencing switch in the NORMAL position, all selected pylons will actuate simultaneously with the depression of the bomb/rocket button. The PAIRS position will cause a stepping action from outboard to inboard. (Example: L-4/R-4, L-3/R-3, etc.), each time the bomb/rocket button is depressed and released. If one pair has not been selected, it will automatically step to the next pair for actuation. In the SINGLES position, the stepping sequence begins with L-4 then R-4 and proceeds inboard alternately on each wing actuating the selected pylons. When a pylon has not been selected, it will move automatically to the next pylon inboard on that wing. The stepping sequence will move each time the bomb/rocket button is depressed and released.

In the PAIRS position, the sequencing switch will electrically allow as many pairs of actuations as have been selected before the sequencing switch ready light will be extinguished. The master armament switch must then be recycled to put the stepping switch to the most outboard pylons again. In the SINGLES position, the sequencing switch will electrically allow as many single actuations as have been selected before the sequencing switch ready light will be extinguished. The master armament switch must then be recycled to put the stepping switch to the most outboard pylons again.

To prevent the possibility of inadvertent dropping of stores, the pilot must determine prior to turn into the target that the position of the pylon function switches are properly placed for the store on that pylon.

Sequencing Switch Ready Light

The sequence switch ready light (6, figure 1-22) when illuminated, indicates the deployment of selected stores has been properly programmed. The ready light does not indicate stores will be dropped or fired properly; (i. e. rocket pods could be dropped or bombs dropped unarmed if function switches are not properly set). The light may be tested for operation by pressing the warning lights test button.

The ready light, if sequence is properly programmed, will illuminate with the sequencing switch in any position; however, the light should be disregarded while in the NORMAL position. When the deployment of stores is not intended, it is good practice to place the sequencing switch to the NORMAL position.

When deploying stores, set function, arming, and sequencing switches as desired, then turn ON master armament switch. If it is desired to reposition function switches after actuating master armament switch, select the desired functions and recycle the master armament switch to obtain proper operation, then check ready light for illumination.

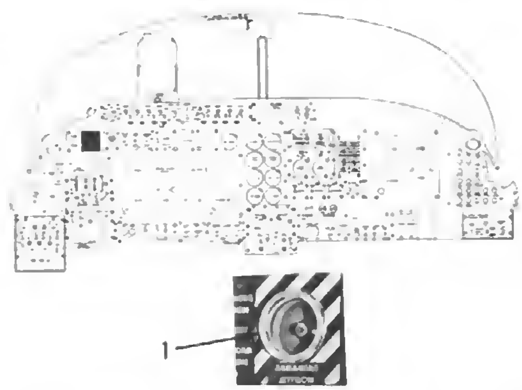
Bomb Arming Switch

The bomb arming switch (3, figure 1-22) is located on the armament control panel. This switch is used when general purpose bombs are installed on the aircraft. The switch has four positions, NOSE, TAIL, BOTH and OFF. With the switch in the NOSE position bombs are dropped nose armed. With the switch in the TAIL position bombs are dropped tail armed. When the switch is in the OFF position the bombs are dropped safe. The BOTH position arms both the nose and tail of the bomb when it is dropped. The switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

Pylon Function Switches

There are eight pylon function switches (1, figure 1-22). These are labeled and in a position to correspond to each pylon with the L1 through L4 to the left

ARMAMENT JETTISON BUTTON

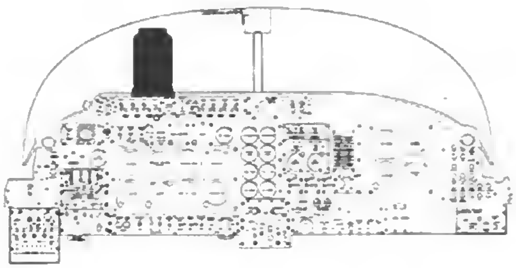


1. ARMAMENT JETTISON BUTTON

Figure 1-23

▲ AIRCRAFT 67-14776 THRU 68-7973 EXCEPT AIRCRAFT MODIFIED PER T. O. 1A-37B-504.

GUNSIGHT



1. SIGHT GLASS
2. MIL DEPRESSION LEVER
3. RETICLE LIGHT SOURCE

Figure 1-24

and R1 through R4 to the right. Each switch has three positions, FIRE, OFF and DROP. In the FIRE position the pylon hooks remain closed and 28 volt dc is directed to the electrical connector for actuation of installed dispensers when the bomb/rocket button is depressed. When the function switch is placed in the OFF position, power is disconnected. In the DROP position, 28 volt dc power is directed to the pylon solenoid, when the bomb/rocket button is depressed, to open the hooks and allow stores to free fall from the rack. These switches are pull out type and must be placed to the desired position and then released to prevent inadvertent movement.

ARMAMENT JETTISON BUTTON

An armament jettison button (figure 1-23), located on the left instrument panel, is provided to jettison external stores in case of an emergency. The button is located in a recessed cup to prevent it from being pushed accidentally. When the button is pushed, the pylon hooks are electricaly opened, as in the normal release, and a squib is fired as a back-up system to insure the release of the external stores. Pylons remain attached to the aircraft. The button receives its power from the 28 volt dc battery bus and is protected by a circuit breaker. The battery switch does not have to be ON for the system to work.

Note

Stores will drop safe when the jettison button is pressed regardless of the bomb arming switch position.

Nose Gun Rounds Remaining Counter

The nose gun rounds remaining counter (8, figure 1-22), when set with the number of rounds loaded in the nose gun, will show to the nearest ten the number of rounds remaining in the nose gun, after each firing. The counter receives 28 volt dc power from the nose gun and camera switch when the nose gun position is selected.

Note

The nose gun rounds remaining counter may overrun as much as 50 rounds when all ammunition is completely expended.

Nose Gun Rate Switch

The nose gun rate switch (7, figure 1-22) is located next to the nose gun rounds remaining counter, and is a two position switch. The switch controls the firing rate of the nose gun and has HIGH and LOW select positions. In the HIGH position the gun will fire at its full rate of 5800 to 6900 rounds per minute. In the LOW position the firing rate is 3500 to 4500 rounds per minute.

Ground Arm Switch

The ground arm switch (5, figure 1-6) is located to the left and aft of the rudder trim switch on the left

console and is used for testing armament on the ground. The switch is cover-guarded and spring-loaded to the safe position. When held in the ON position, the switch overrides the nose gear safety switch circuit. The switch is protected by a circuit breaker (figure 1-11) and receives its power from the 28 volt dc bus.

Trigger

The trigger (6, figure 1-20) located on the forward side of the control stick grip has two detent positions. With the nose gun and camera switch in the CAMERA position, the first detent activates the gun camera circuit. With the nose gun and camera switch at the NOSE GUN & CAMERA position, the master arm switch ON, and the trigger at the second detent (trigger fully depressed), the gun will fire and camera operation will continue.

CAUTION

> If a nose gun jam occurs, release the trigger within 5 seconds to prevent overload of the gun control box and burning of wires.

Note

> When the nose gun and camera switch is in the CAMERA position, the camera can be operated whenever desired by depressing the trigger to the first detent.

Bomb/Rocket Button

The bomb/rocket button (1, figure 1-20) is located on the left side of the pilot's control stick grip. This switch is used to release tanks, bombs or rockets depending upon the setting of the pylon function switches, and operate the strike camera. Placing the pylon switch in the FIRE position will fire rockets or actuate dispensers. Placing the switch in DROP will drop any store on the pylon.

GUNSIGHT (FIXED RETICLE OPTICAL)

The gunsight (CA-503) (figure 1-24) has an illuminated reticle and an optical system consisting of a Mangin mirror and a depressible combining glass. The optical system produces a collimated reticle image which is reflected from the combining glass to produce the reticle image focused at infinity. The combining glass angle is adjustable by the pilot, producing a reticle image depression from 0 to 270 milliradians from the 0 mil reference line.

The sight has an etched metal reticle containing an outer 200-milliradian diameter broken circle and an inner 100-milliradian broken circle plus a center dot. This reticle is illuminated by three No. 1968 quartz iodide lamps wired in parallel. These 28 volt lamps produce an illuminated image of the reticle. The sight has a red 28 volt lamp located above the depression dial to provide illumination of the dial setting. The combining glass angle is manually adjusted by the pilot by means of a knob affixed to a graduated dial. This dial is integral with a circular cam which actuates a plunger pin to adjust the combining glass angle. The accuracy of a depression angle is ±2 mils at 150 mils depression and ±3 mils at 270 mils depression. The depression scale is calibrated in 5 mil units. With the lever at 0, the zero sight line is 2 degrees (34.9 mils) above the fuselage reference line for parallel harmonization. The unit of measurement used to calibrate the sight is 1 degree = 17.45 mils. The 270 mil depression is measured from this initial point. A total of 300 mils are available to the pilot without interference from the nose of the aircraft.

Mil Lead Control

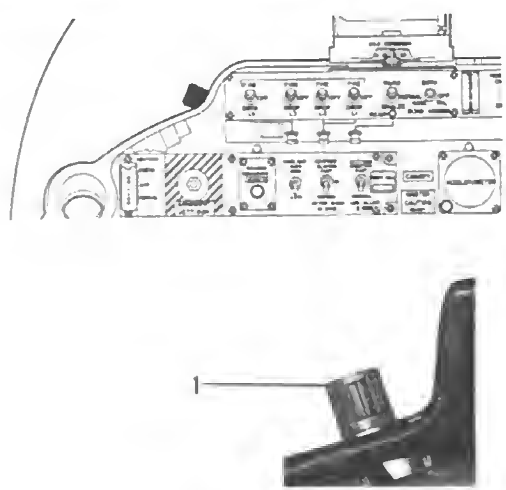
When firing rockets (air-to-ground) or dropping bombs the mil lead is set at a predetermined angle. The desired lead angle varies with the dive angle and speed of the aircraft. The amount of lead or depression can be read from the index on the lever (2, figure 1-24).

GUNSIGHT LIGHT CONTROL

The gunsight light control (figure 1-25) located to the left of the sight on the glare shield, is a rheostat.

The rheostat adjusts the intensity of the reticle image. When the sight is not in use, the rheostat should be turned to OFF to prevent damage to the reticle bulb

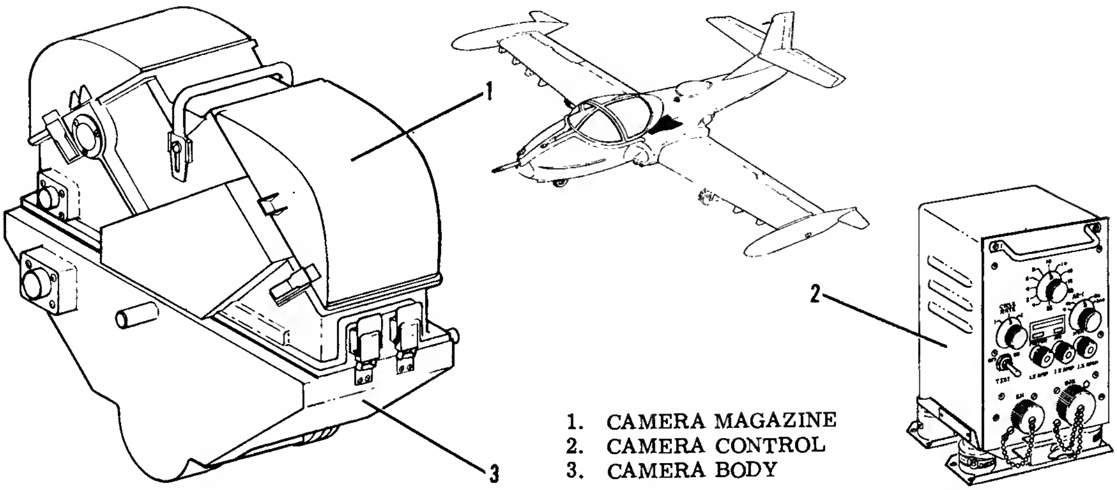
GUNSIGHT LIGHT CONTROL



1. GUNSIGHT LIGHT RHEOSTAT

Figure 1-25

KB-18 CAMERA AND CONTROL



1. CAMERA MAGAZINE
2. CAMERA CONTROL
3. CAMERA BODY

Figure 1-26

in the event of voltage surge. Turning the rheostat to BRIGHT increases the reticle brilliance. The rheostat and lights receive power from the 28 volt dc bus and are protected by a circuit breaker.

GUN CAMERA (KS-27C)

The KS-27C nose gun camera (24, figure 1-1), is located to the left of the taxi light, is an electrically-driven magazine type, 16mm motion picture camera. A transparent gun camera window, mounted in the nose cap, protects the camera lens. The camera does not have the capability of photographing the sight reticle; only the target during gun, rocket and bomb runs. The film speed control, camera overrun time (0 to 3 seconds), and the shutter aperature control must be preset before takeoff to coincide with light conditions.

Gun Camera Settings and Loading

The camera operating adjustment settings are on the right side of the camera, and should be set prior to flight. If adjustment is necessary there are three controls, the shutter aperature control, the overrun control and the speed control. The overrun control must be fully depressed before attempting to reset, and the camera not operating if the speed control must be changed. The f stops are on the front of the camera and have a range from f/2. 8 to f/22 and may be changed if necessary to agree with light conditions.

The magazine when loaded with film is ready for installation and use. When installing magazine to camera body make sure that dust and undesirable material is removed. Insert the magazine so that its locating pin enters the mating hole to the right of the camera aperature and the camera locating pin enters the slot near the back end of the magazine. Make sure the magazine cover is closed. Then press the rear of the magazine firmly against the camera body, swing magazine lock in place, and tighten the latch. The camera is ready for operation.

KB-18 STRIKE CAMERA

The KB-18 strike camera (figure 1-26) is located in the bottom of the fuselage just aft of the trailing edge of the wings. The camera is a moving film panoramic type for daylight low-level photography. The camera is mounted in a vertical position and provides fore and aft photographic coverage of 180° along the flight path and 40° laterally. The major components of the camera system are the camera body, magazine and camera control. The camera control contains switches and electronic components necessary for operation of the camera system, such as camera operating time, cycling rate and film exposure. The camera controls are set on the ground prior to use. The camera is ready for operation when the master armament switch is ON and will operate when the bomb/rocket button is depressed. The camera will continue to operate after the bomb/rocket is released for the overrun time of 2 to 32 seconds which is preset on the camera control overrun switch. The camera receives its power from the 28 volt dc bus.

Strike Camera Operation

To photograph for strike assessment proceed as follows:

1. Master armament - ON (cover open).
2. Bomb/rocket button - DEPRESS, hold for coverage of the desired area, then release. The camera will run for the preset overrun time.

COMMUNICATION and ASSOCIATED ELECTRONIC EQUIPMENT

TYPE	DESIGNATION	USE	OPERATOR	RANGE	LOCATION OF CONTROLS
Inter-communication	AN/AIC-18	Pilot and copilot Intercommunication	Pilot or Copilot	Cockpit	Pilot's left side Cockpit Copilot's right side Cockpit
UHF Radio	AN/ARC-51BX OR AN/ARC - 109	Two-way voice Communication	Pilot or Copilot	Line-of-sight	Left Instrument Panel
UHF/ADF	AN/ARA-50	Aircraft-to-aircraft Aircraft-to-ground	Pilot or Copilot	Line-of-sight	UHF Radio Panel
VHF/FM Communication	Magnavox FM622	Two-way voice Communication	Pilot or Copilot	Line-of-sight	Center Instrument Panel
FM Homing	AN/ARA-56	Aircraft-to-aircraft Aircraft-to-ground Homing	Pilot or Copilot	Line-of-sight	VHF/FM Radio Panel
Secure Voice	KY-28	Voice Scramble	Pilot or Copilot	Line-of-sight	Center Instrument Panel
UHF Navigation	TACAN AN/ARN-65	Range Distance and Bearing Information	Pilot or Copilot	Line-of-sight up to 195 miles	Left Instrument Panel
Identification Transponder	IFF/SIF AN/APX-64 AN/APX-72	Automatic and Selective Identification	Pilot or Copilot	Line-of-sight	Forward of Pilot's Quadrant
X-Band Beacon	SST 181X (AN/UPN-25)	Radar Control	Pilot or Copilot	Line-of-sight	Antenna Select Panel
LF/ADF Radio	AN/ARN-83	ADF and LF Receiver	Pilot or Copilot	Up to 200 miles	Aft of Copilot's Quadrant
VHF COMM	WILCOX 807	Two-way voice Communication	Pilot or Copilot	Line-of-sight	Center Instrument Panel
VHF NAV	WILCOX 806 or COLLINS 51R6	Navigation	Pilot or Copilot	Line-of-sight	Center Instrument Panel

ANTENNA LOCATIONS

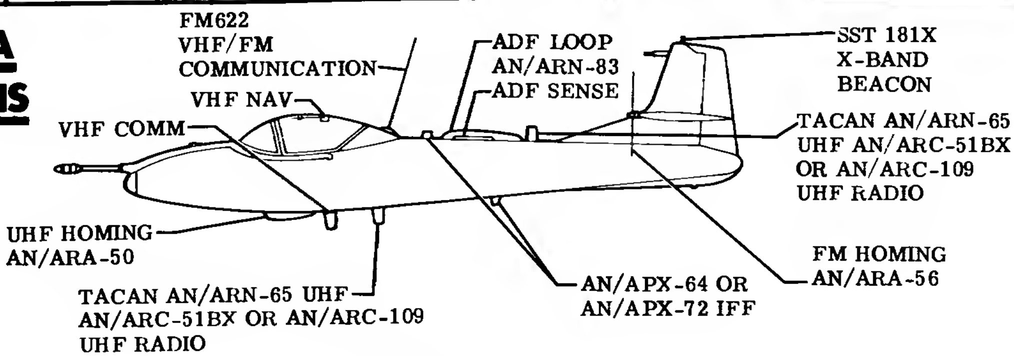


Figure 1-27

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

RADIO COMBINATIONS

The A-37B aircraft is equipped with and has provisions for several radio combinations Figure 1-26A illustrates aircraft by serial number and the equipment which is installed or has provisions for adding various items of equipment.

TABLE OF COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT (See figure 1-27.)

ELECTRONIC EQUIPMENT COOLING

An exhaust fan is provided in the tailcone for cooling of the electronic equipment. Air is exhausted through a louver in the aircraft skin to provide circulation. The fan will operate whenever the main inverter is providing ac power to the system. The cooling fan will not operate when the spare inverter is used.

ANTENNA SELECT SWITCHES

The antenna select switch panel located aft of the pilot's quadrant (figure 1-6), contains three selector switches, and the ON, OFF switch for the X-band beacon. The switches are for selection of antennas for the UHF, IFF and TACAN. Selection of UPPER, AUTO and LOWER can be made to obtain better reception or transmission of radio, navigation and radar signals. In the UPPER position the antennas on top of the fuselage are used. In the AUTO position, automatic sampling of signal strength is done by the individual pieces of equipment and the antenna receiving the stronger signal is automatically selected. In the LOWER position the antennas on the bottom of the fuselage are used for transmission and reception. The IFF will sometimes cause noise in the LF/ADF receiver because of their respective antenna locations and the automatic switching of the IFF antennas. This noise can be eliminated by selecting the LOWER position for the IFF antenna. Each system independently powers and controls its own antenna selector switch.

RADIO COMBINATIONS

EQUIPMENT IS INSTALLED IN AIRCRAFT EXCEPT WHEN MODIFIED PER THE FOLLOWING T.C.T.O.'S:

- □ T.O. 1A-37B-538
- X T.O. 1A-37B-539
- Δ T.O. 1A-37B-542

EQUIPMENT IS INSTALLED IN AIRCRAFT PER THE FOLLOWING T.C.T.O.'S:

- ☆ T.O. 1A-37B-508
- ○ T.O. 1A-37B-538
- ✪ T.O. 1A-37B-539
- ⊛ T.O. 1A-37B-542

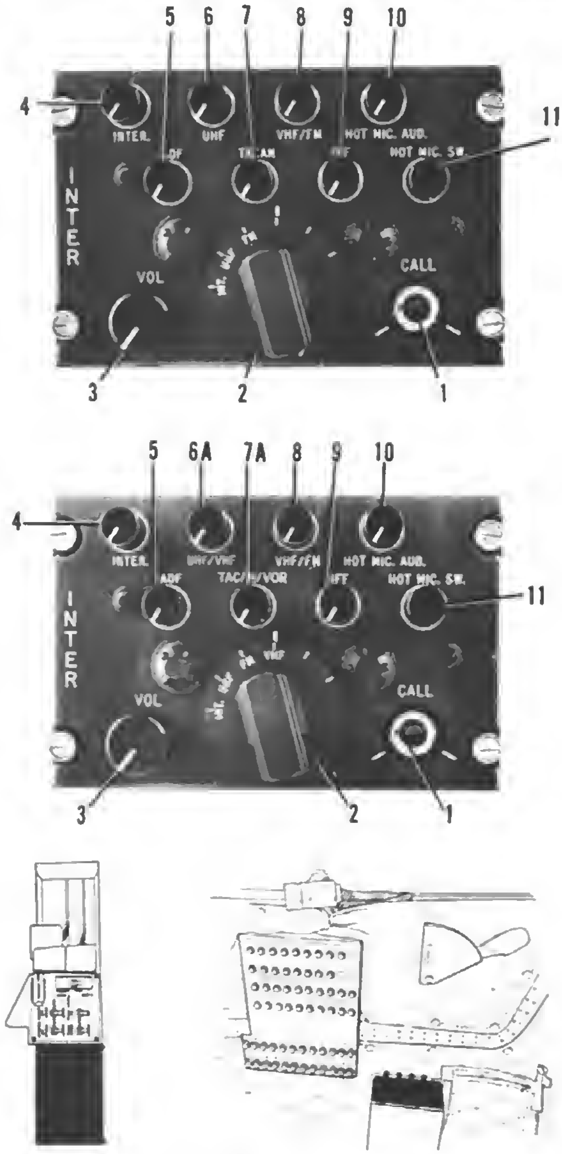
★ INDICATES PROVISIONS FOR INSTALLING EQUIPMENT IS PROVIDED

● INDICATES EQUIPMENT IS INSTALLED

AIRCRAFT SERIAL DEFINITION	AN/AIC-18	AN/ARC-51BX	AN/ARC-109	AN/ARA-50	VHF/AM COMM	KY-28	VHF/FM COMM	AN/ARA-56	AN/ARN-83	AN/ARN-65	VOR	AN/APX-64	AN/APX-72	MODE C	MODE 4	AN/UPN-25
67-14776	●	●		●		★	●	●	●	●		●				
67-14777	●	●		●		★	●	●	●	●		●				●
67-14778 THRU 67-14788	●	●		●		★	●	●	●	●		●				
67-14789 THRU 87-22491	●	●		●		★	●	●	●	●		●				●
68-7911 THRU 68-7912	●	Δ	⊛	●		★	●	●	●	●			●	☆	☆	●
68-7913 THRU 68-7926	●	●		●		★	●	●	●	●		●				●
68-7927 THRU 68-7937	●	Δ	⊛	●		★	●	●	●	●			●	☆	☆	●
68-7938 THRU 88-7943	●	●		●		★	●	●	●	●			●	☆	☆	●
68-7944 THRU 68-7947	●	Δ	⊛	●		★	●	●	●	●			●	☆	☆	●
68-7948 THRU 68-7949	●	●		●		★	●	●	●	●			●	☆	☆	●
68-7950 THRU 68-7952	●	Δ	⊛	●		★	●	●	●	●			●	☆	☆	●
68-7953 THRU 68-7964	●	●		●		★	●	●	●	●			●	☆	☆	●
68-7965 THRU 68-7973	●	Δ	⊛	●		★	●	●	●	●			●	☆	☆	●
68-7974	●	●		●			●	●	●	●			●	☆	☆	●
68-7975	●	✪	X	●			●	●	●	●		○	□			
88-7978 THRU 68-7978	●		●	●		★	●	●	●	●			●			●
68-7979 THRU 88-7980	●	✪	X	●			●	●	●	●		○	□			●
88-10777 THRU 68-10778	●		●	●		★	●	●	●	●			●			●
68-10779 THRU 68-10781	●	✪	X	●			●	●	●	●		○	□			●
68-10782	●		●	●		★	●	●	●	●			●			●
68-10783 THRU 68-10805	●	✪	X	●			●	●	●	●		○	□			●
68-10806	●		●	●		★	●	●	●	●			●			●
88-10807 THRU 68-10810	●	✪	X	●			●	●	●	●		○	□			●
68-10811 THRU 68-10814	●		●	●		★	●	●	●	●			●	☆	☆	●
68-10815 THRU 68-10818	●		●	●	●	★	●	●	●	★	●		●			●
88-10819 THRU 68-10827	●		●	●		★	●	●	●	●			●	☆	☆	●
69-6334 THRU 69-6338	●	✪	X	●			●	●	●	●		○	□			●
89-8339 THRU 89-8381	●		●	●		★	●	●	●	●			●			●
69-6362	●	✪	X	●			●	●	●	●		○	□			●
69-6363 THRU 69-6371	●		●	●		★	●	●	●	●			●	☆	☆	●
69-6372 THRU 69-6376	●		●	●	●	★	●	●	●	★	●		●			●
69-6377	●	✪	X	●			●	●	●	●		○	□			●
69-6378 THRU 69-6399	●		●	●		★	●	●	●	●			●	☆	☆	●
69-6400 THRU 69-6413	●	●		●			●	●	●	●		●				●
89-8414 THRU 69-6417	●		●	●		★	●	●	●	●			●			●
69-6418 THRU 69-6427	●		●	●		★	●	●	●	●			●	●	●	●
69-6428 THRU 69-8436	●		●	●	●	★	●	●	●	★	●		●			●
69-6437 THRU 69-6443	●		●	●		★	●	●	●	●			●	●	●	●
69-6444 THRU 69-6446	●	●		●			●	●	●	●		●				●
70-1277 AND ON	●		●	●		★	●	●	●	●			●	●	●	●

Figure 1-26A

INTERCOMMUNICATION SYSTEM CONTROL PANEL



1. CALL BUTTON
2. MIC SELECTOR SWITCH
3. VOLUME CONTROL
4. INTERPHONE VOLUME ON/OFF SWITCH
5. ADF VOLUME ON/OFF SWITCH
6. UHF VOLUME ON/OFF SWITCH
6A. UHF/VHF VOLUME ON/OFF SWITCH
7. TACAN VOLUME ON/OFF SWITCH
7A. TACAN/VOR VOLUME ON/OFF SWITCH
8. VHF/FM VOLUME ON/OFF SWITCH
9. IFF VOLUME ON/OFF SWITCH
10. HOT MIC AUD VOLUME SWITCH
11. HOT MIC SW ON/OFF SWITCH

Figure 1-28

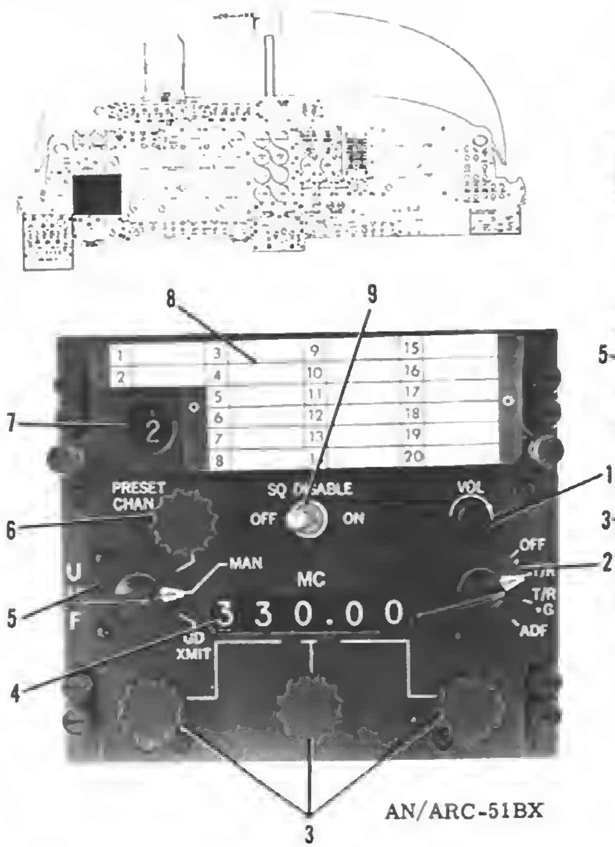
INTERCOMMUNICATION SYSTEM AN/AIC-18 (See Figure 1-26A for serial effectivity)

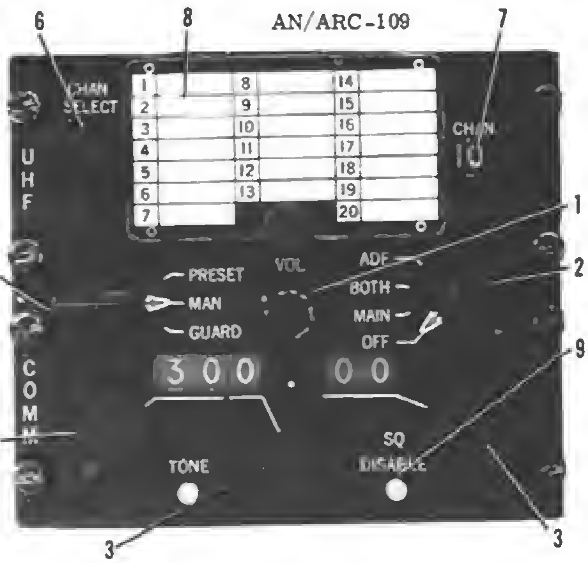
The control panel (figure 1-28) for each pilot is located on their respective side panel (2, 15, figure 1-3). The system acts as a master control for: communication within the aircraft; monitoring of received signals, either individually or simultaneously; and selection of radio for transmission. The system is powered by the 28 volt dc bus and does not have an on-off switch; therefore, when dc power is on and the interphone circuit breaker is in, the system is operational.

Intercommunication System Operation

1. The INTER switch (4, figure 1-28) is a combination on-off switch and volume control. It controls the incoming audio from the other station, except the on-off portion of the INTER switch is by-passed when the CALL button at the other station is pressed in.
2. The UHF switch (6, figure 1-28) is a combination on-off switch and volume control. It controls the incoming audio from the UHF radio in conjunction with the volume control knob on the UHF radio, except the on-off portion of the UHF switch is by-passed when the MIC selector switch is set to UHF.
2A. UHF/VHF volume ON/OFF switch (6A, figure 1-28) is a combination on-off switch and volume control. It controls the incoming audio from the UHF and VHF radios, except the on-off portion of the UHF/VHF switch is not by-passed when the MIC selector is set to VHF.
3. The VHF/FM switch (8, figure 1-28) is a combination on-off switch and volume control. It controls the incoming audio from the FM radio, except the on-off portion of the VHF/FM switch is by-passed when the MIC selector switch is set to FM.
4. The HOT MIC AUD switch (10, figure 1-28) is a volume control for incoming audio when the other station has the HOT MIC SW on.
5. The ADF switch (5, figure 1-28) is a combination on-off switch and volume control for control of incoming audio from the ADF radio.
6. The TACAN switch (7, figure 1-28) is a combination on-off switch and volume control of incoming audio from the TACAN radio.
6A. The TACAN/VOR switch (7A, figure 1-28) is a combination on-off switch and volume control for control of incoming audio from the VOR radio.
7. The IFF switch (9, figure 1-28) is a combination on-off switch and volume control for control of incoming audio from the IFF radio.
8. The HOT MIC SW (11, figure 1-28), when on, enables that station to transmit to the other station without pressing the mic button regardless of the other switch positions at either station. When a station has the HOT MIC SW off and the mic button (6, 12, figure 1-5) is pressed, the selected transmitter will operate and both stations will receive sidetone.
9. The CALL button (1, figure 1-28), when pressed, enables that station to transmit to the other station regardless of other switch positions at either station.
10. The MIC selector switch (2, figure 1-28) enables transmission over the interphone line or

UHF RADIO CONTROL PANEL





1. VOLUME CONTROL KNOB
2. FUNCTION CONTROL KNOB
3. MANUAL FREQUENCY SELECTOR KNOBS
4. FREQUENCY WINDOW
5. MODE CONTROL SWITCH
6. PRESET CHANNEL SELECTOR KNOB
7. CHANNEL INDICATOR WINDOW
8. CHANNEL FREQUENCY CARD
9. SQUELCH DISABLE SWITCH

Figure 1-29

selection and operation of radio transmitters, transmission over the interphone or selected radio will occur when the mic button is pressed.

11. The VOL control (3, figure 1-28) is a master control that operates in conjunction with the other volume controls. It controls all audio to the headphones, except landing gear warning signal.

UHF RADIO - AN/ARC-51BX - AN/ARC-109 (See Figure 1-26A for serial effectivity)

The UHF radio set has a line-of-sight reception and provides voice transmission and reception of the 1750 frequencies in the range of 225. 0 to 399. 9 megahertz. The control panel (figure 1-29) for the set is on the stationary instrument panel and permits selection of any of 20 frequencies which can be preset in any order. In addition, an operating frequency can be set up manually without disturbing any of the preset frequencies. The set uses two receivers, a main and guard receiver. The guard receiver is set and fixed to receive frequency 243. 0 megahertz. The functions of the set are selected by the four-position function control switch (2, figure 1-29). The switch, when moved from the OFF position, connects 28 volt dc power from the 29 volt dc bus to the set. When the switch is in the T/R position, the transmitter and receiver are operative on the same selected main frequency. The T/R+G position allows transmission and reception on the main selected channels and simultaneously reception on the guard channel. The ADF position of the switch integrates the ARA-50 direction finder with the UHF frequency selected and provides automatic direction finder functions. On aircraft ⚠1, the UHF radio and the UHF/ADF, when operated simultaneously, will transmit on the UHF homing antenna. On aircraft ⚠2, when the UHF radio is operated simultaneously with the UHF/ADF, the UHF radio transmits on the lower and upper TACAN and UHF antennas and the UHF/ADF transmits on the UHF homing antenna. Operation of the UHF radio only is on UHF homing antenna. Bearing information to the station is displayed on the BDHI, ADF No. 1 bearing pointer. The auxiliary guard receiver is inoperative in this position. When the selector switch on the UHF control panel is in any position other than OFF the ARA-50 system is automatically put in the stand-by condition. A mode control switch (5, figure 1-29), is used to select the desired operating mode. The MAN position of the

⚠1 AIRCRAFT 67-14776 THRU 70-1306.
⚠2 AIRCRAFT 70-1307 AND ON.

switch permits any desired frequency within the operating range of the set to be manually selected by the manual frequency selector knobs (3, figure 1-29). The XMIT position selects the fixed guard frequency for the main transmitter, and PRESET CHAN is used to allow selection of any of the 20 preset frequencies. When the mode control switch is at PRESET CHAN, subsequent movement of the preset channel selector knob (6, figure 1-29) changes the frequency to the desired preset channel. A numerical indication of the selected channel appears in a window (7, figure 1-29), above the channel selector knob. A record of the frequencies that have been preset and assigned to the 20 channels can be noted on a channel frequency card (8, figure 1-29). The squelch disable switch (9, figure 1-29) is a two-position switch for control of the receiver squelch. The normal position of the switch is ON. If squelch noise in the audio system becomes uncomfortable placing the switch to OFF will clear the squelch noise. The preset frequencies can be changed in-flight if necessary. The volume (1, figure 1-29) control knob has a bearing on the volume in the pilot's headset and should be adjusted in conjunction with the UHF control on the AIC-18 panel.

Note

When the A-37B aircraft is loaded with pylon tanks, the ARA-50 UHF homing system develops errors. These errors are caused by the reflected signals from the pylon tanks. The prevalence and magnitude of the errors decrease sharply when frequencies above 240 megahertz are used for homing. Errors are also present in the UHF homing system when the aircraft is operated at an altitude of less than 3000 feet due to reflected signals from the ground. It is, therefore, recommended that when pylon fuel tanks are installed on the aircraft, frequencies above 240 megahertz be used for homing purposes.

Operation of UHF Radio

1. Select PRESET CHAN position with the mode control switch.
2. Rotate function control switch to T/R or T/R+G position and allow approximately one minute to warm-up main and guard receiver units.
3. With preset channel selector knob, select the desired channel after warm-up. Set is now ready for use.
4. Adjust volume control for desired audio level.
5. For manual selection of a frequency that is not included in the preset channels, set mode control switch to MAN. Turn the three manual frequency selector knobs at the bottom of the panel until the numerals indicating the desired frequency appear in the windows.

Note

The microphone button should be released before changing transmitter frequency. Approximately four seconds should elapse before transmission begins on a new frequency.

Note

If a stuck mic button is suspected, proceed as follows. Turn the HOT MIC SWITCH - OFF, and turn the rotary selector switch to INT. If you can transmit over the interphone without depressing the mic button, you have a stuck button. If this condition exists, turn radio OFF if on the ground. If airborne, turn the rotary switch (AIC-18) to a blank position. To transmit, turn rotary selector switch to desired transmitter and then back to a blank position when transmission is complete.

6. To obtain transmission and reception of the guard frequency, move mode control switch to GD-XMIT.

Note

Function control knob must be in T/R +G to receive guard frequency.

7. To obtain direction finding information move function control switch to ADF. Read information on the BDHI, ADF No. 1 bearing pointer.

CAUTION

On aircraft ▲, do not key the UHF radio while operating in the UHF/ADF mode.

8. To turn off receiver-transmitter, move function control switch to OFF.

VHF COMMUNICATIONS/NAVIGATION SYSTEM
(See Figure 1-26A for serial effectivity)

The VHF communications/navigation system consists of the VHF communications set and the VHF navigation receiver. All operating controls are on the instrument panel (figure 1-29A) and are accessible to both the pilot and copilot. The system receives power from the 28 volt dc bus through a circuit breaker located on the main circuit breaker panel on the right side of the aircraft. The frequency range of the communication set is from 116.00 MHz to 149.975 MHz in 50 KHz steps. The range of the set is line-of-sight. It provides 680 crystal-controlled channels of very high frequency, amplitude modulated communications. The frequency range of the navigation receiver is 108.00 to 117.95 MHz in 50 KHz steps. The range of the set is line-of-sight. It provides 200 crystal-controlled very high frequency channels when navigating with the radio compass.

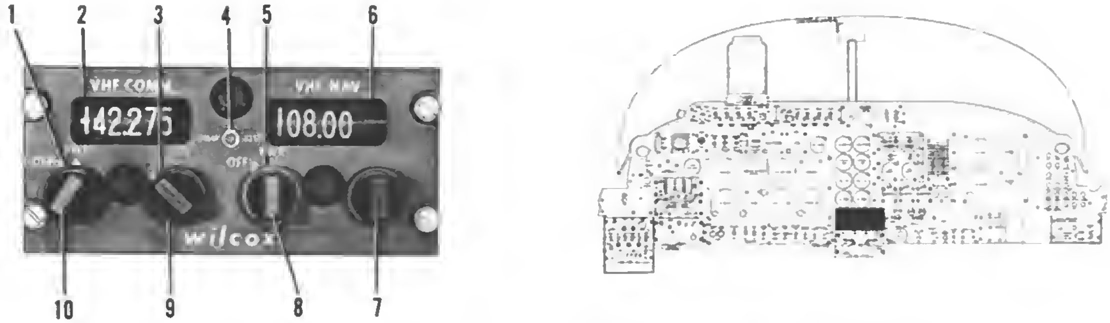
VHF COMMUNICATIONS SYSTEM.

VHF COMM Power Control Knob

The VHF COMM power control knob (1, figure 1-29A) is a two position rotary switch. The OFF position removes power from the set. The PWR position applies power to the set.

▲AIRCRAFT 67-14776 THRU 70-1306.

VHF/VOR CONTROL PANEL



1. VHF COMM POWER CONTROL KNOB
2. VHF FREQUENCY INDICATOR
3. VHF VOLUME CONTROL KNOB
4. COMM TEST BUTTON
5. VHF NAV POWER CONTROL KNOB
6. VOR FREQUENCY INDICATOR
7. VOR FRACTIONAL MEGAHERTZ SELECT KNOB
8. VOR MEGAHERTZ SELECT KNOB
9. VHF FRACTIONAL MEGAHERTZ SELECT KNOB
10. VHF MEGAHERTZ SELECT KNOB

Figure 1-29A

VHF COMM Volume Control Knob

The VHF COMM volume control knob (3, figure 1-29A) determines the level of audio applied to the interphone set.

Note

> The UHF/VHF control knob (6A, figure 1-28) and the VOL control knob (3, figure 1-28) on the interphone panel will also affect the level of the audio from the VHF/FM receiver as heard in the headsets.

COMM TEST Button

The COMM TEST button (4, figure 1-29A) is a spring-loaded button which will disable the squelch as long as it is held down. The button is used to ascertain proper receiver operation.

VHF COMM Frequency Indicator

The VHF COMM frequency indicator (2, figure 1-29A) presents a horizontal row of six digits indicating the operating frequency of the set.

VHF COMM Fractional Megahertz Select Knob

The VHF COMM fractional megahertz select knob (9, figure 1-29A) controls the decimal portion of the operating frequency as shown on the frequency indicator.

VHF COMM Megahertz Select Knob

The VHF COMM megahertz select knob (10, figure 1-29A) controls the whole megahertz portion of the operation frequency as shown on the frequency indicator.

Operation of the VHF Communication System

The VHF communication system is operated according to the following steps:

1. VHF COMM power control knob - Set to PWR. Allow 5 minutes for the set to warm up.

Note

> The receiver in the set will be usable instantly. The transmitter will be usable approximately one minute after it is energized. However, waiting the full 5 minutes before keying transmitter will assure long life of the set.

2. VHF COMM frequency select knobs - SET.
3. COMM TEST button - depress.

Note

> Receiver background noise is audible. Preadjust volume during test.

4. Transmission is accomplished by rotating the microphone selector switch (2, figure 1-28) to VHF, turning the UHF/VHF volume ON/OFF switch (6A, figure 1-28) clockwise approximately one quarter turn, pressing the transmit button, and speaking into the microphone.
5. When station called answers, readjust volume as desired (4, 6A, figure 1-28).
6. To turn equipment off, set VHF COMM power control knob to OFF.

VHF NAVIGATION SYSTEM

VHF NAV Power Control Knob

The VHF NAV power control knob (5, figure 1-29A) is a two position, rotary switch. The PWR position applies power to the set. The OFF position removes power from the set.

VHF NAV Volume Control

The VHF NAV volume is controlled by the TACAN/VOR control knob (7A, figure 1-28) and the VOL control knob (3, figure 1-28) on the interphone panel.

VHF NAV Frequency Indicator

The VHF NAV frequency indicator (6, figure 1-29A) presents a horizontal row of five digits indicating the operating frequency of the set.

VHF NAV Fractional Megahertz Select Knob

The VHF NAV fractional megahertz select knob (7, figure 1-29A) controls the decimal portion of the operating frequency as shown on the VOR frequency indicator.

VHF NAV Megahertz Select Knob

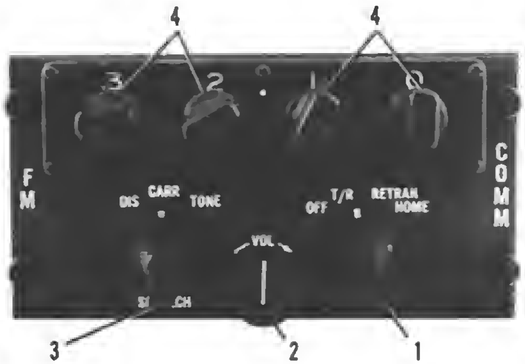
The VHF NAV megahertz select knob (8, figure 1-29A) controls the whole megahertz portion of the operation frequency as shown on the VOR frequency indicator.

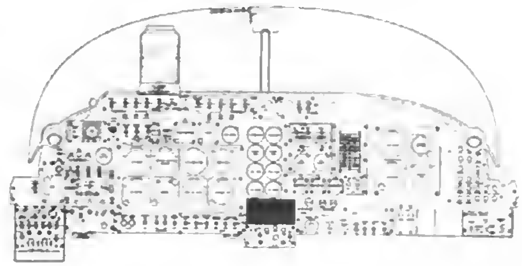
Operation of the VHF Navigation System

The VHF NAV navigation system is operated according to the following steps:

1. VHF NAV power control knob - Set to PWR.
2. Frequency select knobs - SET.
3. Refer to AF Manual 51-37 for VOR navigation.
4. To turn equipment off, set VHF NAV power control knob to OFF.

VHF/FM COMMUNICATIONS CONTROL PANEL





1. MODE SELECTOR SWITCH
2. VOLUME CONTROL KNOB (INOPERATIVE)
3. SQUELCH CONTROL KNOB
4. FREQUENCY SELECTOR KNOBS

Figure 1-30

VHF/FM COMMUNICATION SYSTEM

The FM 622 communication system is installed for VHF/FM communication. The receiver is electrically tuned and crystal controlled and covers the frequency range of 30 to 76 megahertz in 50 kilohertz steps to provide a total of 920 channels. Two modes of operation are available; transmit and receive and home. The system receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

VHF/FM Communications Control Panel

The VHF/FM communications control panel (figure 1-30) on the instrument panel, incorporates a mode selector switch (1, figure 1-30), frequency indicator windows, a volume control knob (2, figure 1-30) a squelch control switch (3, figure 1-30), and four frequency selector knobs. The mode selector switch (1, figure 1-30) has four positions, OFF, T/R, RETRAN and HOME. In the OFF position power to the system is off. The T/R position is the push to talk position. When the mike button on the throttle is depressed normal communications may be accomplished. The RETRAN position is inoperative in this installation. The HOME position activates the system with the AN/ARA-56 FM Homing, and activates the CDI (figure 1-31) providing homing capabilities. The volume control on the AIC-18 adjusts the audio input level of the radio set. The squelch control (3, figure 1-30) is a three position switch. In the DIS position the squelch circuits are disabled and are not usable in the normal operation. In the CARR position or normal operating position the squelch circuits operate normally in the presence of any carrier. The TONE position is inoperative. The frequency selector knobs (4, figure 1-30) are used to select the megahertz digits of the desired operating frequency. The windows above the knobs display the selected and operating frequency of the radio set. Any frequency from 30 to 75.95 MH_z may be selected.

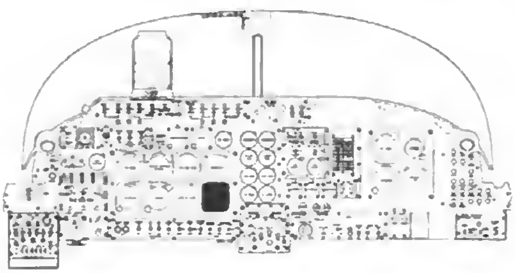
Operation of the VHF/FM Communication System

1. Set the mode control to T/R - Allow equipment to warm-up.
2. Set squelch control to CARR.
3. Select desired frequency.
4. Adjust volume control for comfortable listening level (AIC-18).
5. Microphone switch - Depress to transmit - Release to receive.
6. Turn the mode control to OFF to turn the radio off.

Operation of the VHF/FM Homing System

1. Set the mode control to HOME. Allow equipment to warm-up.
2. Set the squelch control to CARR.
3. Select desired frequency. Any signal within the frequency range of the radio can be used for homing if it is strong enough as indicated by the CDI (figure 1-31).
4. Fly the aircraft toward the homing station by heading in the direction that causes the CDI to center. To solve ambiguity, after turning toward the CDI, if the CDI centers, flight is toward the station. If the CDI continues to move away, flight is away from the station.
5. Station passage will be indicated by a swinging motion of the CDI then a constant setting.
6. Turn the mode switch to OFF to turn the radio off.

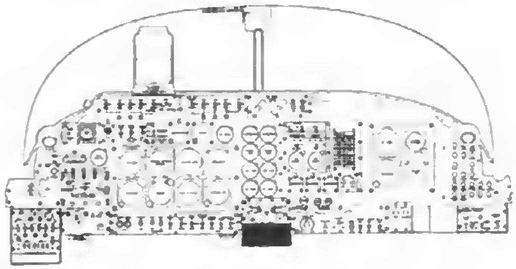
HOMING INDICATOR



1. COURSE DEVIATION INDICATOR (CDI)
2. WARNING FLAGS
3. MARKER LIGHT (INOPERATIVE)
4. GLIDE PATH INDICATOR (INOPERATIVE)

Figure 1-31

KY-28 SECURE VOICE



1. ZEROIZER
2. DELAY (RETRANS) SWITCH
3. MODE SWITCH
4. POWER SWITCH

Figure 1-32

SECURE VOICE COMMUNICATIONS SYSTEM

The KY-28 speech security system is used with the UHF and VHF communications systems. The KY-28 system is comprised of C-7213 control radio set, mounted at the bottom of the stationary panel, and the KY-28 coder, MT-38301A mount and RE-978/ARC relay, located on the right-hand side of the aft radio shelf in the tailcone section. The components operate in conjunction with the UHF and VHF communications FM 622 systems and the system receives power from a 5-ampere circuit breaker.

Operation of the KY-28 System

WARNING

Do not make simultaneous secure/insecure transmissions. If operation does not proceed as outlined, switch to PLAIN VOICE. DO NOT PASS CLASSIFIED TRAFFIC.

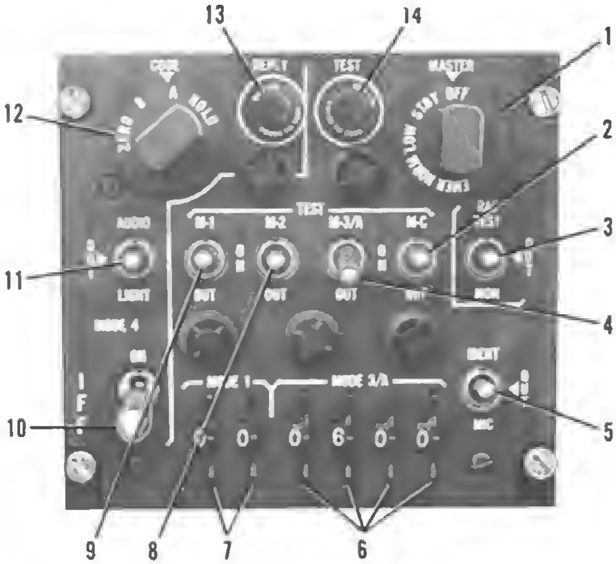
KY-28

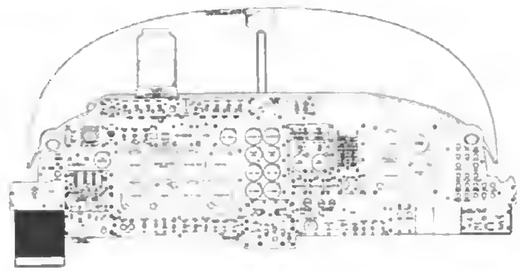
1. DAILY KEY: Set.
2. CONNECTORS: Connected.

REMOTE CONTROL UNIT

1. POWER SWITCH: On.
2. DELAY (RETRANS) SWITCH: (Off) Down.

IDENTIFICATION TRANSPONDER CONTROL PANEL





1. MASTER CONTROL SWITCH
2. MODE C SELECT SWITCH
3. RAD TEST MONITOR SWITCH
4. MODE 3/A SELECT SWITCH
5. IDENTIFICATION SWITCH
6. MODE 3/A CODE SELECT SWITCHES
7. MODE 1 CODE SELECT SWITCHES
8. MODE 2 SELECT SWITCH
9. MODE 1 SELECT SWITCH
10. MODE 4 ON-OUT SWITCH
11. MODE 4 AUDIO-LIGHT SWITCH
12. MODE 4 CODE SWITCH
13. MODE 4 REPLY LIGHT
14. TEST LIGHT

Figure 1-33.

3. MODE SWITCH: Plain.
4. MAKE TEST TRANSMISSION.
5. MODE SWITCH: Cipher.
6. PUSH-TO-TALK SWITCH: Depressed. Steady tone and then alternating two-tone signal will be heard in headset/speaker.
7. PUSH-TO-TALK SWITCH: Again depressed, wait for beep tone.
8. SYSTEM READY FOR OPERATION.

Note

a. Prolonged STEADY tone indicates trouble.
b. If ALTERNATING signal does not stop; press PUSH-TO-TALK switch, hold, and release again.
c. If no BEEP tone is heard, turn POWER switch OFF and ON again. Repeat step 7. If BEEP tone still not heard, switch to PLAIN and OBSERVE WARNING.

IDENTIFICATION TRANSPONDER - AN/APX-64 OR AN/APX-72 (See Figure 1-26A for serial effectivity)

The identification transponder system provides automatic radar identification and altitude reporting information in response to coded interrogations from ground or airborne stations The transponder responses will also identify the transmitting aircraft as a friendly aircraft within a group of specific aircraft. A supplementary purpose of the transponder system is to provide momentary identification of position upon request. It will also provide momentary identification of position upon request and to transmit a specially coded response to indicate an emergency. In addition, the signals returned from the transponder can be used at the interrogating station to determine range and azimuth information The transponder system receives interrogating signals on a frequency of 1030 megahertz and transmits responses on a frequency of 1090 megahertz. Power to the transponder system is provided by the 28 volt dc bus and the 115 volt ac single phase bus. The transponder system is protected by circuit breakers (figure 1-11 and figure 1-12) and a fuze (figure 1-12).

The transponder system is capable of using five operational modes (Modes 1, 2, 3/A, C and 4) and can superimpose four special signals on the mode replies. Except for the preset Mode 2, the mode of operation is selected on the identification transponder control panel (figure 1-33).

The IFF capability, controlled by internal selector swiches (set by ground personnel only), provides for the following methods of reply coding: Mark X, Mark XSIF, or Mark XII. The Mark X configuration provides for use of the IFF (transponder) control portion only. Selection of reply coding is limited to

a one code reply combination which is preset into the equipment. When using the Mark XSIF configuration, the SIF (Selective Identification Feature) control portion of the panel is used in conjunction with the IFF control of the panel, providing for selection of the reply coding through the code combinations available with the SIF control portion of the panel. When using the Mark XII configuration, the Mode 4 function provides for a secure (encrypted) IFF capability through incorporation of a computer and a pressure altitude digitizer within the transponder system and a computer at the interrogating facility.

The aircraft is equipped with an AN/APX-64 or AN/APX-72 transponder. The basic function of both transponders is the same. The AN/APX-72 is transistorized for lighter weight and less current drain Warmup time does not exceed one minute under standard conditions or two minutes under extreme conditions If properly warmed up, there will be no delay in response to interrogations.

The antenna system is comprised of two antennas and a switching circuit. The system is controlled by a switch located on the left instrument panel (figure 1-6). This switch has three positions: UPPER, AUTO and LOWER. With the switch in the AUTO position, the switching circuit determines which antenna is receiving the stronger interrogation and routes the response signal through the same antenna. The automatic switching feature can be enacted by selecting either the UPPER or LOWER position at the antenna select switch which selects the corresponding antenna.

Tests have shown that the lower antenna will give the best radar return when the aircraft is flying away from the ground radar antenna. The upper antenna will give the best return when inbound, during a VOR penetration and holding. Normally the AUTO position of the antenna select switch will select the proper antenna and should be used unless a malfunction is suspected. Either the UPPER or LOWER position may be used in the event of an AUTO malfunction.

The transponder can also be used to determine range and azimuth information. In general, the interrogating station is composed of a directionally beamed surveillance radar and coincidentally-beamed interrogator responsor antenna. The time delay between transmission of the interrogation pulses and receipt of the returned coded signals can be used to determine the range of the responding aircraft. The direction of the beamed signal at the time of receipt of a response, furnishes azimuth information The radar and interrogation pulses are triggered in synchronization so that the range and azimuth from both the radar echo and the transponder reply can be displayed on the radar scope. Location, identification and altitude of aircraft equipped with the AN/APX-72 Transponder are available to all challenging stations within operating range of the system.

Identification Transponder Control Panel

The identification transponder control panel (23, figure 1-2 and figure 1-33) is located on the lower left portion of the instrument panel. The panel provides cockpit control of all modes of operation except for the preset Mode 2.

The MASTER control switch (1, figure 1-33) is a five position rotary switch. The switch turns the transponder system on and off, selects the desired receiver sensitivity, and provides for emergency operation. In the OFF position, the transponder system is inoperative. In the STBY position, the transponder is placed in a warmup (stand-by) condition In the LOW position, power is applied to the transponder, but operation sensitivity is reduced and replies are transmitted only in the presence of strong intterogation. In the NORM position, power is applied to the transponder for operation at normal receiver sensitivity. In the EMER position (the knob must be pulled out before it can be turned to EMER), the transponder automatically transmits emergency reply signals.

The Mode 1 select switch (9, figure 1-33), is marked M-1, ON, OUT and TEST. In the ON position, the transponder replies to Mode 1 interrogations. The OUT position disables the transponder replies to Mode 1 interrogations. In the TEST position, the transponder may be locally interrogated while also replying. When the reply is satisfactory, the green TEST light (14) will illuminate.

The Mode 1 code select switches (7, figure 1-33) select and indicate the Mode 1 two-digit reply code number.

The Mode 2 select switch (8, figure 1-33), is marked M-2, ON, OUT and TEST. In the ON position, the transponder replies to Mode 2 interrogations. The OUT position disables the transponder replies to Mode 2 interrogations. In the TEST position, the transponder may be locally interrogated while also replying. When the reply is satisfactory, the green TEST light (14) will illuminate.

The Mode 3/A select switch (4, figure 1-33), is marked M-3/A, ON, OUT and TEST. In the ON position, the transponder replies to Mode 3/A interrogations. The OUT position disables the reply to Mode 3/A interrogations. In the TEST position, the transponder may be locally interrogated while also replying. When the reply is satisfactory, the green TEST light (14, figure 1-33) will illuminate.

The Mode 3/A code select switches (6, figure 1-33) select and indicate the Mode 3/A four-digit reply code number.

The Mode C select switch (2, figure 1-33, 1-26A), marked M-C. ON, OUT and TEST, controls the altitude reporting function of the identification transponder. In the ON position, the transponder will reply to Mode C interrogations. In the OUT position, the reply to Mode C interrogations is disabled. In the TEST position, the transponder may be interrogated while also replying. When the reply is satisfactory, the green TEST light (14, figure 1-33, 1-26A) will illuminate.

The Mode 4 ON-OUT switch (10, figure 1-33, 1-26A) enables the transponder to decode Mode 4 interrogations in the ON position. In the OUT position, the Mode 4 decode function is disabled. Selection of the OUT position requires pulling out on the toggle lever before moving the switch to OUT.

The Mode 4 audio-light switch (11, figure 1-33, 1-26A), marked AUDIO, LIGHT and OUT, selects the aircraft indication for Mode 4 replies. In the AUDIO position, an aural signal in the pilot's headset and illumination of the green Mode 4 REPLY light (13, figure 1-33, 1-26A) indicates that Mode 4 code replies are being transmitted. In the LIGHT position, the green Mode 4 REPLY light will illuminate when Mode 4 replies are transmitted. Mode 4 audio volume can be adjusted by the IFF switch (9, figure 1-28, 1-26A). In the OUT position, both light and audio indications are inoperative.

The Mode 4 code switch (12, figure 1-33, 1-26A) marked CODE A, B, ZERO and HOLD, selects either of the two (A or B) Mode 4 codes. At a designated time, the Mode 4 code for the present code period is mechanically set in position A, and the code for the succeeding code period is set in position B. Placing the Mode 4 code switch in the applicable A or B position allows the transponder to reply to interrogations from a station using the same code setting as that set into the aircraft. In the ZERO position, with aircraft power on and the MASTER control switch in any position except OFF, both code settings can be zeroized. The switch knob must be pulled out before it can be turned to ZERO. Both codes will be automatically zeroized when power is turned off after the aircraft has landed. In the spring-loaded HOLD position, with transponder power still applied, both code settings A and B may be retained when aircraft power is turned off. Power must be available for at least 15 seconds or the code settings may zeroize.

Note

To hold the code settings, the aircraft landing gear must be down and locked and the transponder power must be on for at least 15 seconds.

The Mode 4 REPLY light (13, figure 1-33, 1-26A) indicates the presence of Mode 4 replies.

The RAD TEST and MON switch (3, figure 1-33) is a three-position toggle type switch marked RAD TEST, OUT and MON. The switch is spring-loaded from the RAD TEST position to the OUT position. In the RAD TEST position, the output power of the individual modes can be tested. Other functions of this switch are classified. In the MON position, the receiver sensitivity can be checked. The green TEST light (14, figure 1-33) will illuminate when the function being checked is acceptable.

The identification switch (5, figure 1-33), marked IDENT, OUT and MIC, is spring-loaded from the IDENT to the OUT position. The IDENT position, when momentarily actuated, initiates I/P reply code operation for approximately 30 seconds. In the MIC position, with the microphone button depressed and the MIC selector switch (2, figure 1-28) on the AN/AIC-18 control panel set to UHF, approximately 30 seconds of I/P reply code will be transmitted. The OUT position disables the IDENT reply from the transponder system.

The TEST light (14, figure 1-33) illuminates when the transponder properly responds to a Mode 1, 2 3/A or C test.

Modes of Operation:

1. For Mode 1 operation, select NORM or LOW position on the master control switch and set the Mode 1 select switch to the ON position. Depending on the selection of the Mode 1 code select switches, a total of 32 different reply code combinations are available.
2. For Mode 2 operation, select NORM or LOW position on the master control switch and set the Mode 2 select switch to the ON position. Mode 2 can be preset to select any one of 4096 possible reply code combinations for discrete identification of the aircraft.
3. For Mode 3/A operation, select NORM or LOW position on the master control switch and set the Mode 3/A select switch to the ON position. Depending on the selection of the Mode 3/A code select switches a total of 4096 reply code combinations are available. Mode 3/A operation provides Air Traffic Control (ATC) correlation of aircraft radar targets with their individually filled flight plans.

4. For Mode C operation, select NORM or LOW position on the master control switch and set the Mode C select switch to the ON position. The altitude digitizer selects one of 2048 reply code combinations to be transmitted.
5. For Mode 4 operation, select NORM, LOW or EMR position on the master control switch and set the Mode 4 switch to the ON position. Place the Mode 4 code switch to either A or B position, as directed. Place the Mode 4 audio-light switch to either the AUDIO or LIGHT position. The number of Mode 4 code reply combinations is classified.

Special Signal Mode of Operation:

1. A special I/P (Identification of Position) reply code can be selected by the pilot for transmission to permit the ground controller to distinguish between two aircraft displaying identical coding or to establish the position of any given aircraft. The reply code is transmitted for approximately 30 seconds each time the identification switch is placed in the IDENT position. In the MIC position, with the microphone button depressed and the MIC selector switch (2, figure 1-28) on the AN/AIC-18 control panel set to the UHF position, approximately 30 seconds of I/P reply code will be transmitted. For I/P operation, the MASTER control switch must be in NORM or LOW and the Mode 1, 2 or 3/A select switches in the ON position.
2. A special emergency code may be selected for transmission when an aircraft is in distress. Placing the master control switch in the EMER position causes automatic transmission of emergency reply signals that enable the interrogating radar to single out the aircraft in an emergency condition from within a group of aircraft.

SST-181X X-BAND RADAR TRANSPONDER (See Figure 1-26A for serial effectivity)

The SST-181X pulse type radar tracking aid is to extend the tracking range of such precision tracking radar as the M33, AN/APN-59, AN/MPQ-29, AN/TSP-31, AN/SPS-23, and similar X-Band tracking and instrumentation radars. To accomplish this function, the SST-181X receives either coded or single pulse interrogation and transmits a single pulse reply in the same frequency band. The switch that turns on power to the SST-181X is located (13, figure 1-6) aft of the pilots quadrant on the antenna select panel and is a two-position OFF-ON switch.

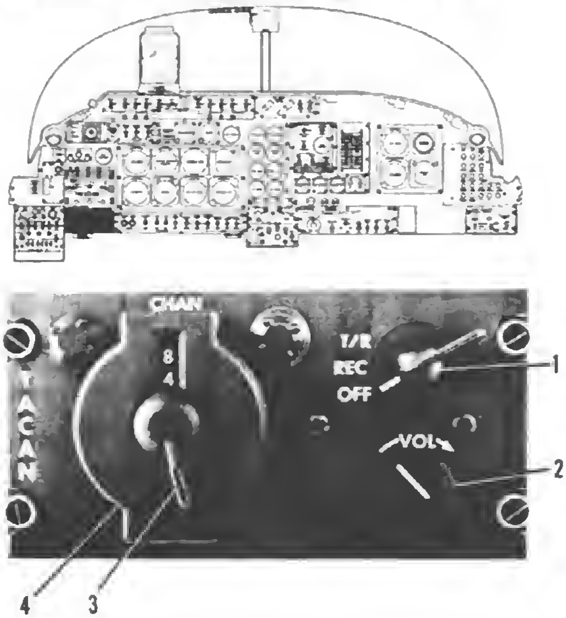
TACTICAL AIR NAVIGATION SYSTEM (TACAN) AN/ARN-65 (See Figure 1-26A for serial effectivity)

The TACAN (tactical air navigation) system is capable of giving bearing and slant range to a TACAN station. The ARN-65 transmits an interrogation signal from the aircraft to the TACAN station which receives the same signal and retransmits it back to the aircraft. The equipment in the aircraft accepts only the answer to its interrogation signal. By an electronic measurement of the elapsed time, the range information is computed and shown on the range indicator. This range figure is given as slant range in nautical miles from the aircraft down to the TACAN station. The TACAN station also transmits a Morse code identification signal every 38 seconds. The AN/ARN-65 has a line-of-sight range of about 195 miles.

Note

The TACAN will not operate off the spare inverter.

TACAN CONTROL PANEL



1. FUNCTION SWITCH
2. VOLUME CONTROL KNOB
3. 0 TO 9 CHANNEL SELECTOR SWITCH
4. 0 TO 12 CHANNEL SELECTOR SWITCH

Figure 1-34

Tactical Air Navigation System (TACAN) AN/ARN-65 Control Panel

Function Switch

When the function switch (1, figure 1-34) is at T/R, the AN/ARN-65 starts transmitting an interrogation signal to the TACAN station for range information and also receives bearing information from the TACAN station. Moving the function switch to REC stops the transmitting of the interrogation signal and only bearing information is received from the TACAN station. The range indicator is inoperative and an off flag drops across the figures. Power for the switch is supplied by the 28 vdc bus and the single phase ac bus.

Channel Selector Switch

The two channel selector switches (3 and 4, figure 1-34) permits selection of any of 126 channels for air-to-ground transmissions. These channels cover 1025 MH_Z to 1150 MH_Z with a one MH_Z separation. Each switch is a circular knob. The outer knob selects numbers from 0 to 12; the inner knob selects numbers from 0 to 9; thus any combination of channels up to 126 can be set up in the channel window. Power for the channel selector switches is from the single phase ac bus.

Note

Allow about 12 seconds after channel selection for the TACAN bearing pointer and the range indicator to correctly indicate the new information.

Volume Control Knob

The volume control knob (2, figure 1-34) is inoperative. The volume is adjusted on the AIC-18.

OPERATION OF AN/ARN-65 (TACAN)

To operate the AN/ARN-65 radio, proceed as follows:

1. Rotate channel selector switch to TACAN station desired.
2. Move function switch to either REC or T/R and allow about 2 minutes for warm-up, or until TACAN bearing pointer stops spinning.

Note

A false lock on may occur momentarily; however, the TACAN bearing pointer will release and stabilize on the magnetic bearing of the TACAN station.

3. Adjust the volume as desired on the AIC-18 panel.
4. Verify station identification.
5. Observe course deviation indicator for disappearance of course warning flag.
6. To home on TACAN station:
   a. Turn aircraft until the No. 2 TACAN bearing pointer is under the top indice on the BDHI (figure 1-36).
   b. Rotate SET knob on course indicator to select desired radial (figure 1-37).
   c. Read slant range on range indicator (3, figure 1-36).

Note

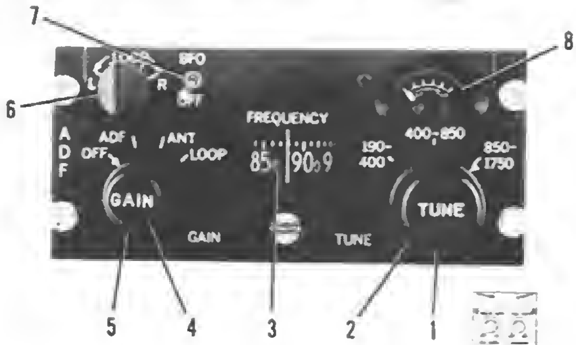
If the function switch is at T/R, the range indicator will show a reduction in mileage as the aircraft approaches the TACAN station, and an increase in mileage as the aircraft flies away from the TACAN station.

7. To turn equipment off, move function switch to OFF.

Note

After the AN/ARN-65 is turned off, the No. 2 TACAN bearing pointer rotates freely.

L F NAVIGATION CONTROL PANEL



1. TUNING KNOB
2. BAND SELECTOR SWITCH
3. FREQUENCY DIAL
4. GAIN CONTROL KNOB
5. FUNCTION SELECTOR SWITCH
6. LOOP CONTROL SWITCH
7. BEAT FREQUENCY OSCILLATOR SWITCH
8. TUNING METER

Figure 1-35

LF NAVIGATION SYSTEM AN/ARN-83

The AN/ARN-83 Automatic Direction Finder is provided for LF Navigation. The receiver may be used as a range receiver or direction finder within the range of 190 to 1750 kilohertz. The frequency range is covered in three separate bands which may be selected on the LF navigation control panel (2, figure 1-35). Operation of the direction finder loop is automatic or can be manually operated by controlling the loop switch (6, figure 1-35). The Automatic Direction Finder receives power from both the 28 volt dc bus and the 26 volt ac system. The dc bus is protected from overload by a 5 amp circuit breaker located on the circuit breaker panel. The ac system is protected by a 2 amp fuse located on the fuse panel (figure 1-11).

LF NAVIGATION CONTROL PANEL

The LF navigation control panel (figure 1-35) has a GAIN control knob (4, figure 1-35), a frequency dial (3, figure 1-35) and a function selector switch (5, figure 1-35) labeled OFF, ADF, ANT and LOOP. The function selector switch selects the type of operation desired of the receiver. In the ADF position, the receiver operates as an automatic direction finder. In the ANT position, the system operates as an LF receiver and in the LOOP position, the system operates as a direction finder when the LOOP switch (6, figure 1-35) is actuated either to the left or right. The OFF position turns the power off to the system. The LOOP switch (6, figure 1-35) is a momentary switch and may be actuated to either the left or right of the center position. The loop may be rotated away from a directional indicator to test operation of the loop or to set the loop to a desired azimuth depending upon the setting of the function selector switch. The band selector switch (2, figure 1-35) selects the desired frequency range. As the switch is changed from one frequency to another, the frequency range will appear on the frequency dial. The tuning knob (1, figure 1-35) is used to select a particular frequency on any of the three bands. The tuning meter (8, figure 1-35) will indicate the strength of the received station and is used to tune maximum signal strength. The beat frequency oscillator (7, figure 1-35) may be used to tune in a station properly even though the station is too weak to hear intelligibly or to operate the tuning meter. The GAIN control knob has a bearing on the volume in the pilot's headset and should be adjusted in conjunction with the VOL control on the AIC-18 panel.

Note

With the IFF antenna in close proximity to the LF/ADF antenna noise of sufficient strength to cause undesirable operation can result. To eliminate the noise select the LOWER, IFF antenna.

OPERATION OF LF NAVIGATION SYSTEM AN/ARN-83

1. Function selector switch - ANT position.
2. Gain control knob - As required.
3. Band selector switch - Desired frequency range.
4. Tuning knob - Desired station frequency.
5. Volume control knob (AIC-18) - Adjust for comfortable level.
6. Function selector switch - OFF, (to turn receiver off).

As an Automatic Direction Finder

1. Function selector switch - ANT position.
2. Gain control knob - As required.
3. Band selector switch - Desired frequency range.
4. Tuning knob - Desired station frequency.
5. Function selector switch - ADF position. Adjust tuning knob for maximum deflections on tuning meter.
6. Volume control knob (AIC-18) - Readjust for comfortable level.
7. BDHI - Read magnetic bearing.
8. Loop switch - Check operation of ADF on station by operating loop switch to left or right. ADF bearing pointer should return to same bearing when the switch is released. If the ADF bearing pointer does not return to the same bearing ±3°, the signal should not be used for ADF navigation.
9. Function selector switch - OFF, (to turn receiver off).

As a Manually Controlled Direction Finder

1. Function selector switch - ANT position.
2. Gain control knob - As required.
3. Band selector switch - Desired frequency range.
4. Tuning knob - Desired station frequency.
5. Function selector switch - LOOP position.

6. BFO switch - ON.
7. LOOP switch - Adjust, left or right, for null location.
8. Gain control knob - Readjust for desired null width.
9. Function selector switch - OFF, (to turn receiver off).

BEARING-DISTANCE-HEADING INDICATOR

The BDHI (figure 1-36) is a multi-purpose instrument powered by the 115 volt and 26 volt single phase ac circuits. The BDHI consists of a rotating compass card, an ADF bearing pointer, a TACAN bearing pointer, a range indicator, and a range warning flag. The compass card rotates as the aircraft turns, so that the magnetic heading of the aircraft is under the index at the top of the instrument.

The No. 1 pointer operates as the ADF bearing pointer and indicates the magnetic bearing to an LF/MF station provided the compass is operating properly. When the ADF function of the UHF Command Radio is selected, the No. 1 bearing pointer is disconnected from the LF navigation receiver. It will indicate the magnetic bearing to the source of the transmission for the selected UHF radio frequency. The No. 2 bearing pointer provides TACAN bearing information and may be read directly from the compass card as magnetic bearing to the station. The TACAN bearing pointer operates when the TACAN function switch is in REC or T/R positions.

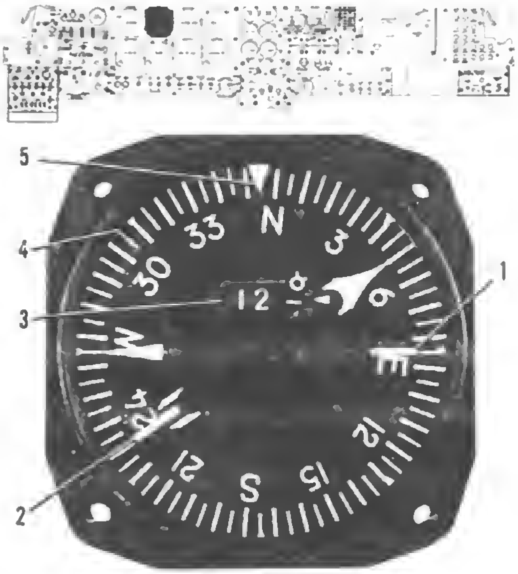
If the signal is lost or is blocked, a memory circuit maintains the last bearing received for 3 seconds. If the signal is still disrupted after the time limit, the TACAN bearing pointer will spin counterclockwise until the signal is again received.

Note

> An inherent error exists in the TACAN system and may appear as a false bearing indication of plus or minus 40 degrees or multiples of 40. Whenever possible, TACAN bearing indications should be confirmed with known bearings. TACAN instrument departures and penetrations should be monitored by ground radar to verify TACAN bearing information whenever possible. If false lock-on is suspected, change to another frequency and return to original frequency to regain positive lock-on.

The range indicator displays the slant range distance in nautical miles from the aircraft to the TACAN station selected. It operates only when the TACAN function switch is in the T/R position. The range warning flag covers the range figures whenever the signal is disrupted or the aircraft is beyond the range of the equipment. A memory circuit retains the last range received for 10 seconds, after which time either the range warning flag comes into view or the range indicator will unlock and search continuously. When a signal of sufficient strength is again received, the

BEARING, DISTANCE, HEADING INDICATOR



1. ADF BEARING POINTER
2. TACAN BEARING POINTER
3. RANGE INDICATOR
4. COMPASS CARD
5. HEADING INDEX

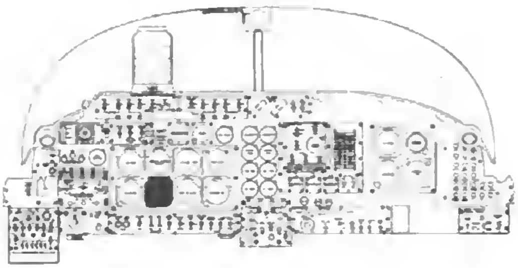
Figure 1-36

range indicator will function normally with the warning flag out of view.

COURSE INDICATOR

Signals are directed into the course indicator (figure 1-37) from the TACAN receiver to operate the course deviation indicator (CDI) (2, figure 1-37) for course guidance. A heading pointer (5,. figure 1-37) and heading deviation scale show the heading of the aircraft to the right or left of the selected course, both to and from the selected station. The CDI has a maximum deflection of about 10 degrees either side of the course centerline. A course set knob (4, figure 1-37), on the lower left corner of the instrument is used to select a desired course, the magnetic value of which appears in the course selector window (8, figure 1-37) at the top of the instrument. The indicator in the upper left corner (7, figure 1-37) of the instrument displays TO and FROM indication, which signifies whether the selected course, if intercepted and flown, would take the aircraft to or from the TACAN station selected. The instrument also has a glide slope indicator (3, figure 1-37) and marker beacon light (1, figure 1-37) both of which are not used on this aircraft. The indicator is provided with red warning flags (6, figure 1-37) for both the CDI and the glide slope indicator. The course warning flag becomes visible at anytime a received signal is unreliable, and when the equipment is shutoff, either

COURSE INDICATOR



1. MARKER BEACON LIGHT (INOPERATIVE)
2. COURSE DEVIATION INDICATOR
3. GLIDE SLOPE INDICATOR (INOPERATIVE)
4. COURSE SET KNOB
5. HEADING POINTER
6. WARNING FLAGS
7. TO-FROM INDICATOR
8. COURSE INDICATOR

Figure 1-37

intentionally or because of electrical power failure. The glide slope warning flag is nonfunctional on this aircraft and is visible at all times. The course indicator receives its power from the 28 volt dc bus and 115 volt ac three phase bus. Failure of either electrical source will render the course indicator inoperative.

Note

> The course indicator and the bearing-distance-heading indicator operate independently of each other and it is possible to have one operating normally without the other.

LIGHTING EQUIPMENT

EXTERIOR LIGHTING

Two poisition lights, four navigation lights, two formation lights, two landing lights, one taxi light, one AR boom light and two anti-collision beacons, provide exterior lighting for both in-flight and ground operation. The position, navigation and formation lights are controlled by switches in the cockpit which provide a selection of dim or bright, and steady or flashing circuits. One white position light is located on the upper centerline of the fuselage aft of the canopy and the other on the lower centerline of the fuselage; these lights are not on the flashing circuit. One navigation light is located on each wing tip tank, a green light on the right and a red light on the left. Aircraft ▲ has two tail lights, one white and one amber, located on the tailcone stinger. Aircraft ▲ has one flashing white light located on the tailcone stinger. The formation lights are located under the horizontal stabilizer forward of the elevator with one on each side. One landing light is flush mounted on the under side of each wing aft of the landing gear and the taxi light is mounted in the nose. These lights are controlled by a single selector switch, and the nose gear downlock switch. One red anti-collision beacon is located on the upper surface of the aircraft, aft of the canopy, and the other on the lower surface of the fuselage. The anti-collision beacons are controlled by a switch located on the switch panel. With the switch in the ON position, the anti-collision beacons will be operating to show a rotating red beacon. If the nose gear is down and locked, the landing lights will be operable. If the nose gear is in any other position, except down and locked, the landing lights will not come down and on.

Navigation Light Switches

The position, navigation and formation lights are operated by two switches (9, figure 1-6). One of the

▲ AIRCRAFT 67-14776 THRU 68-10816 EXCEPT MODIFIED PER T. O. 1A-37-512.
▲ AIRCRAFT 68-10817 AND ON, WHEN MODIFIED PER T. O. 1A-37-512.

switches is three-position: FLASH, OFF and STEADY. The other switch is two-position: DIM and BRIGHT. With the switches in the FLASH and BRIGHT positions the navigation lights will be bright and flashing and the position lights will be bright with the formation lights out. With the STEADY and DIM positions selected all lights will be dim and steady, and the formation lights will be illuminated. The lights receive their power from the 28 volt dc bus.

Anti-Collision Beacon Lights Switch

The anti-collision beacons switch (7, figure 1-6), has two positions: ON and OFF. In the ON position, the two red anti-collision beacons are turned on. The anti-collision beacons receive their power from the 28 volt dc bus.

Note

> The anti-collision beacons switch should be in the OFF position during flight through conditions of reduced visibility when the pilot could experience vertigo as a result of the rotating reflections of the lights against the clouds.

Landing and Taxi Light Switch

The landing and taxi light switch (1, figure 1-4) has LANDING, OFF and TAXI positions. When the switch is in the LANDING position, the flush-mounted landing light in each wing is extended and automatically turned on, provided the nose gear is down and locked. In the OFF position, the landing lights are retracted flush with the wings and automatically turned off. In the TAXI position, the taxi light in the nose is turned on. The landing and taxi lights receive their power from the 28 volt dc bus.

CAUTION

> Damage to the landing light extension motors may be caused by extending the lights above 156 KIAS.

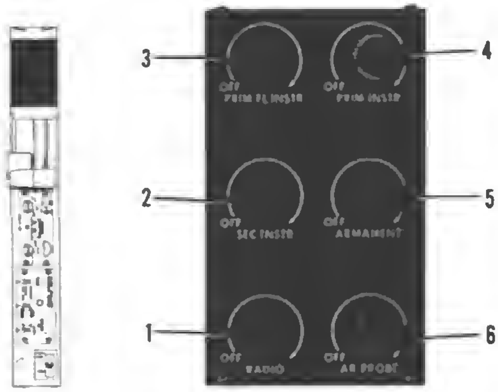
AR Probe Light Rheostat

The AR probe light rheostat (6, figure 1-38), when rotated clockwise will increase light intensity from off to full bright. The light is located on the nose of the aircraft and illuminates the probe and drogue for night air refueling operations. The rheostat and light receive their power from the 28 volt dc bus. The rheostat is inoperative and the light is removed on aircraft without air refueling probe installed.

INTERIOR LIGHTING

Interior lighting equipment includes two cockpit lights, five secondary instrument lights, individual instrument lights and edge lighting for the switch panel, radio control panels, oxygen regulators, portions of the left instrument panel, lower portion of the stationary instrument panel, the armament panel and the intercommunication control panels located on either side of the cockpit. Intensity for all lighting equipment is controlled by six rheostat switches.

INTERIOR LIGHT SWITCHES



1. RADIO LIGHTS
2. SECONDARY INSTRUMENTS LIGHTS
3. PRIMARY FLIGHT INSTRUMENT LIGHTS
4. PRIMARY INSTRUMENT LIGHTS
5. ARMAMENT LIGHTS
6. AR PROBE LIGHT

Figure 1-38

COCKPIT LIGHTS

Primary Flight Instrument Lights Rheostat

The primary flight instrument lights rheostat (3, figure 1-38), controls the intensity of the compass, clock and all of the flight instruments. The rheostat receives its power from the 28 volt dc bus.

Compass Light Switch

A two-position compass light switch is provided for turning off the light during air refueling operation or whenever desired. The ON, OFF switch (10, figure 1-2) is located to the left of the compass and receives 28 volt dc power.

Primary Instrument Lights Rheostat

The primary instrument lights rheostat (4, figure 1-38), controls the intensity for the edge lighting of the switch panel and parts of the left instrument panel and lower portion of the stationary instrument

panel, flap position indicator, both oxygen regulators, accelerometer and all the engine and pressure instruments. Power to the rheostat comes from the 28 volt dc bus.

Secondary Instrument Lights Rheostat

The secondary instrument light rheostat (2, figure 1-38) controls the intensity of the five lights located under the glare shield, that illuminate the instrument panel. Power to this rheostat comes from the 28 volt dc bus.

Radio Lights Rheostat

The radio lights rheostat (1, figure 1-38) controls the intensity of the edge lighting for all radio control panels located on either side of the cockpit. Power for this rheostat is supplied by the 28 volt dc bus and the circuit is protected by the same circuit breaker that protects the primary instrument lights circuit.

Armament Lights Rheostat

The armament lights rheostat (5, figure 1-38) controls the intensity of the edge lighting for the armament panel and associated armament switches in the instrument panel. Power for this rheostat is supplied by the 28 volt dc bus.

Warning Lights Switch

The annunciator panel and warning light in the cockpit are controlled by a two-position, BRIGHT and DIM switch (8, figure 1-6). This provides for control during day or night operation of all warning lights. The switch receives its power from the 28 volt dc bus.

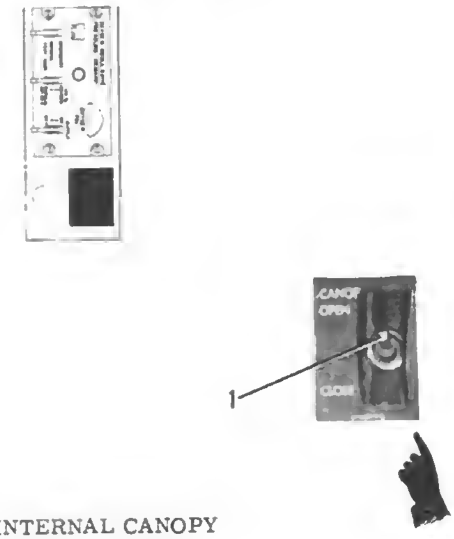
AR Panel Lights Switch

A two-position BRIGHT and DIM switch is provided on the AR panel (3, figure I-13) for control of the panel lights when it is in use. The switch receives its power from the 28 volt dc bus.

CANOPY

A clear plastic shatter resistant canopy covers the entire cockpit area, and can be jettisoned in-flight or while the aircraft is on the ground. The canopy is opened or closed electrically by internal or external canopy switches. In the closed position, manually operated canopy downlocks, on each side of the canopy, are engaged to lock the canopy to the closed position. During all normal canopy operations, the downlock handles must be manually pulled aft before the canopy can be raised or lowered electrically; however, a thruster provision in the jettison mechanism unlocks the downlocks automatically during canopy jettisoning. Emergency jettisoning of the canopy is accomplished by pulling up on the ejection seat arming handles, or by pulling the external canopy jettison handle. In the event no electrical power is available to operate the canopy actuator, a mechanical declutch provision allows the canopy to be

INTERNAL CANOPY CONTROL



1. INTERNAL CANOPY CONTROL SWITCH

Figure 1-39

manually opened or closed from inside or outside of the aircraft. During taxiing operation the canopy should be full open or down and locked.

INTERNAL CANOPY CONTROL SWITCH

The internal canopy control switch (figure I-39) has two positions, OPEN and CLOSED, and is spring-loaded to the OPEN position. With the canopy closed and locked, moving either canopy downlock handle back to the unlocked position will automatically open the canopy. To close and lock the canopy, this switch must be held in the CLOSED position until the canopy downlock handle is forward and locks the canopy. Travel limit switches within the canopy actuator automatically disengage the actuator motor when travel to the full open or closed position is reached. This switch is deactivated by a micro-switch on the canopy downlock handles whenever they are moved forward to the locked position. The switch receives its power directly from the 28 volt dc battery.

CANOPY CONTROL SWITCH

The canopy control switch (figure 1-40) has two positions, EXTERNAL and INTERNAL. The EXTERNAL position disconnects the internal canopy switch from the circuit and allows normal operation of the external switches. The INTERNAL position overrides the external canopy switches and the canopy will

EXTERNAL CANOPY CONTROLS

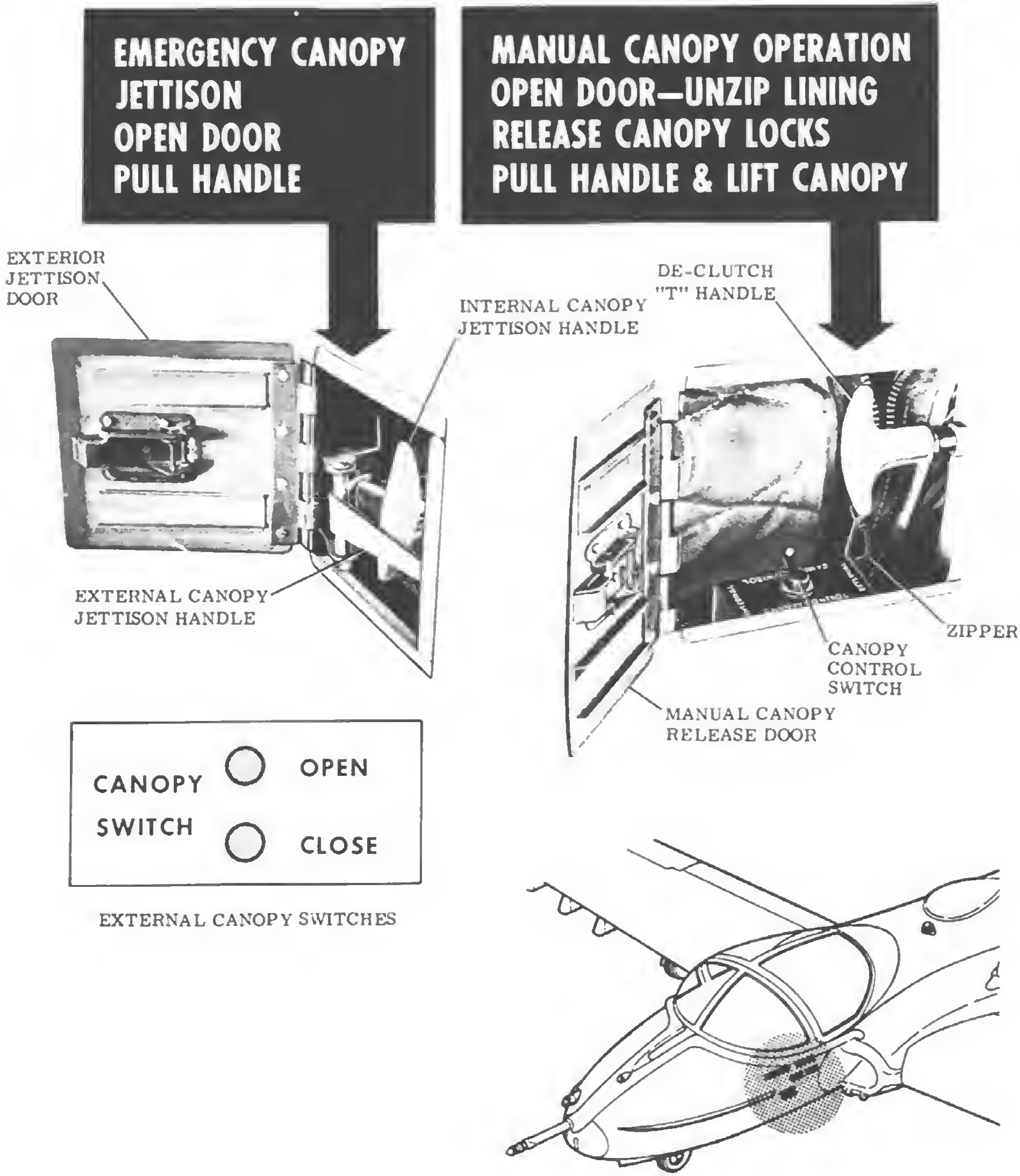


Figure 1-40

move to the full open position if the canopy is unlocked and battery power is available. This switch must be in the INTERNAL position for all normal operations.

CANOPY DOWNLOCK HANDLES

The canopy downlock handles (1, 14, figure 1-3) are interconnected to permit manually locking and unlocking of the canopy from either the pilot's or co-pilot's seat. Moving either handle forward locks the canopy. Before the canopy can be opened or closed normally, the canopy downlock handles must be moved back to the unlocked position.

CANOPY-NOT-LOCKED WARNING LIGHT

The red, canopy-not-locked warning light on the instrument panel (11, figure 1-4) illuminates when the battery switch is ON and the canopy downlock handles are not fully forward. The warning light receives its power from the 28 volt dc bus.

CAUTION

The light will go out whether the canopy is down and locked or not, as long as handles are in the forward LOCKED position.

EXTERNAL CANOPY SWITCH

The canopy can be opened electrically by external canopy switches marked CANOPY SWITCH, OPEN, CLOSE (figure 1-40). Each spring-loaded switch must be held in until the canopy travel has reached the desired position. The switches use 28 volt dc power from the battery to operate the canopy actuator motor.

CANOPY JETTISON HANDLE

The canopy jettison handle (figure 1-40) permits the pilot to jettison the canopy from the cockpit when seat ejection is not contemplated or for a ground crew to jettison the canopy for emergency entrance to the cockpit.

CANOPY PWR SELECT SWITCH

The CANOPY PWR SELECT switch, located in the left nose compartment, has two positions: NORM and EXT PWR. The switch allows the canopy to be opened or closed when using an auxiliary power unit. The switch is a toggle-type, spring-loaded from the NORM to the EXT PWR position. When positioned to the EXT PWR position, the switch directs 28 volt dc power from the auxiliary power unit to the CANOPY CONTROL switch and to the external CANOPY SWITCH. To raise the canopy, using an auxiliary power unit, position the CANOPY CONTROL switch to EXT PWR, and simultaneously press the external CANOPY SWITCH marked OPEN. To close the canopy, using and auxiliary power unit, repeat the procedure using the external CANOPY SWITCH marked CLOSE.

CANOPY DE-CLUTCH "T" HANDLE

The canopy de-clutch "T" handle (figure 1-40) is provided for maintenance operation when 28 volt dc power is not available to operate canopy actuator motor. Opening or closing the canopy can be accomplished manually using the canopy de-clutch "T" handle in the following manner:

1. Open the manual canopy release door.
2. Release downlocks if locked.
3. Pull and hold de-clutch "T" handle located just inside the canopy manual release door and lift canopy.
4. Release de-clutch "T" handle to hold canopy open.
5. To close the canopy, manually hold canopy and pull the de-clutch "T" handle gently lowering canopy until closed.

CAUTION

Due to the weight of the canopy, two crew members one on each side, are required to open and close the canopy using the canopy de-clutch "T" handle.

RAIN REMOVAL SYSTEM

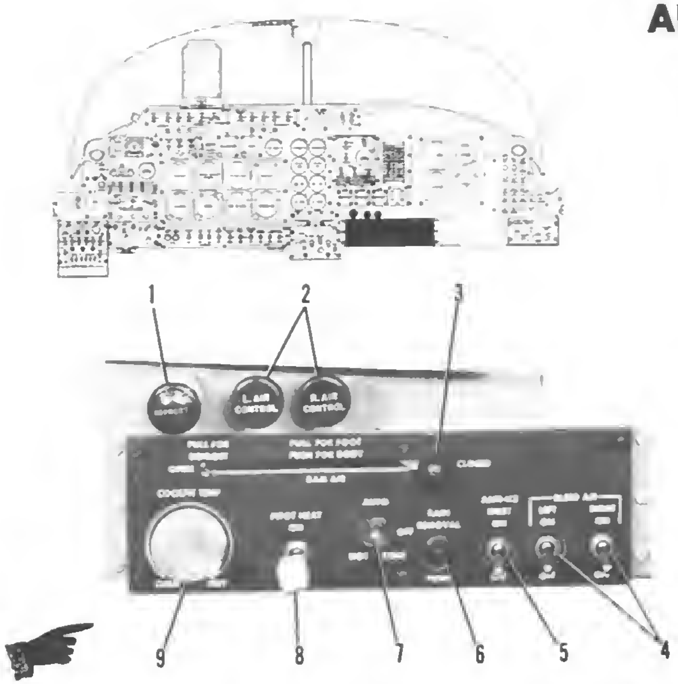
The rain removal system is a manually operated electrically actuated, in-flight applied, rain repellent system. The system consists of 8 fixed nozzles, a pressurized disposable fluid container located in the nose with a sight gage, a solenoid valve, a time delay and a push button switch located on the air conditioner control panel (6, figure 1-41). When the switch is depressed, the solenoid valve and time delay are activated simultaneously, allowing repellent fluid to be ejected through the nozzles onto the windshield. At the completion of the time cycle, the timer interrupts power to the solenoid valve, shutting off the supply of the fluid. The system will dispense approximately 10cc of fluid during each application cycle. The length of time an application remains effective varies inversely with the rain intensity. The repellent lasts longer in heavy rain because the larger quantity of water spreads and disperses the repellent over the entire area of the windshield and creates a better chemical bond than is achieved in light rain.

WARNING

Do not apply to a dry windshield or in light rain when rain removal is not required. Do not make frequent consecutive applications in moderate rain as an oily residue will form on the windshield which can affect pilot visibility.

The sight gage is used to determine when the fluid container is nearly empty. When the air space appears at the top of the gage, an additional 6 to 8 applications of fluid remain in the container, before servicing becomes necessary. The system receives its power from the 28 volt dc bus.

AIR CONDITIONING, RAM AIR AND DEFROSTING CONTROLS



1. WINDSHIELD AND CANOPY DEFROST KNOB
2. AIR CONTROL KNOBS
3. RAM AIR LEVER
4. BLEED AIR SWITCHES
5. ANTI-ICE INLET SWITCH
6. RAIN REMOVAL BUTTON
7. COCKPIT AIR TEMPERATURE CONTROL SWITCH
8. PITOT HEAT SWITCH
9. COCKPIT AIR TEMPERATURE CONTROL RHEOSTAT

Figure 1-41

COCKPIT AIR CONDITIONING, VENTILATION AND DEFROSTING SYSTEM

The air conditioning system utilizes bleed air from the engine compressors to supply air for heating or cooling the cockpit. Bleed air from each engine compressor passes through check valves and manually operated shutoff valves to a modulating valve. The modulating valve diverts a selected amount of air through a heat exchanger and then a refrigeration unit. Bleed air and refrigerated air are then mixed in the mixing muff and pass through a water separator where moisture is condensed from the air. The air enters the cockpit at a preselected temperature through air outlets on the glare shield, on both sides of the cockpit, on each side of the copilot's quadrant and in the area just forward of the feet along each side of the cockpit. The air conditioning system is powered by the 28 volt dc bus and 115 volt ac single phase bus.

COCKPIT AIR CONDITIONING CONTROLS

Cockpit Air Temperature Control Switch

Temperature of the air admitted to the cockpit is controlled by a four-position cockpit air temperature control switch (7, figure 1-41). Temperature control is maintained automatically when the switch is in the AUTOMATIC position. When the switch is in the OFF position, the automatic control system is inoperative and the modulating valve remains fixed in the position at the time the switch was set to the OFF position. If the automatic control system fails or if desired temperature cannot be obtained with the switch in the AUTOMATIC position, the switch may be held in the HOT or COLD position until the desired temperature of the cockpit air is reached. The switch is spring-loaded to the center OFF position from the HOT or COLD position. The switch receives power from the 28 volt dc bus.

Note

If inverters fail, resulting in complete loss of ac power, the air conditioning system will be inoperative in the AUTOMATIC position and the manual HOT or COLD position must be selected to maintain desired cockpit temperature.

BLEED AIR SWITCHES

Bleed air to the air conditioning system is controlled by two switches (4, figure 1-41), on the air conditioner control panel. These switches are located in the right side of the control panel. The switches control bleed air from each engine and are labeled RIGHT and LEFT for the right and left engine bleed air. The switches are two-position ON and OFF. In the ON position the shutoff valve is open allowing bleed air to pass to the air conditioner. In the OFF position the shutoff valve is closed. The bleed air system is powered by the 28 volt dc bus.

AIR CONDITIONING, RAM AIR,

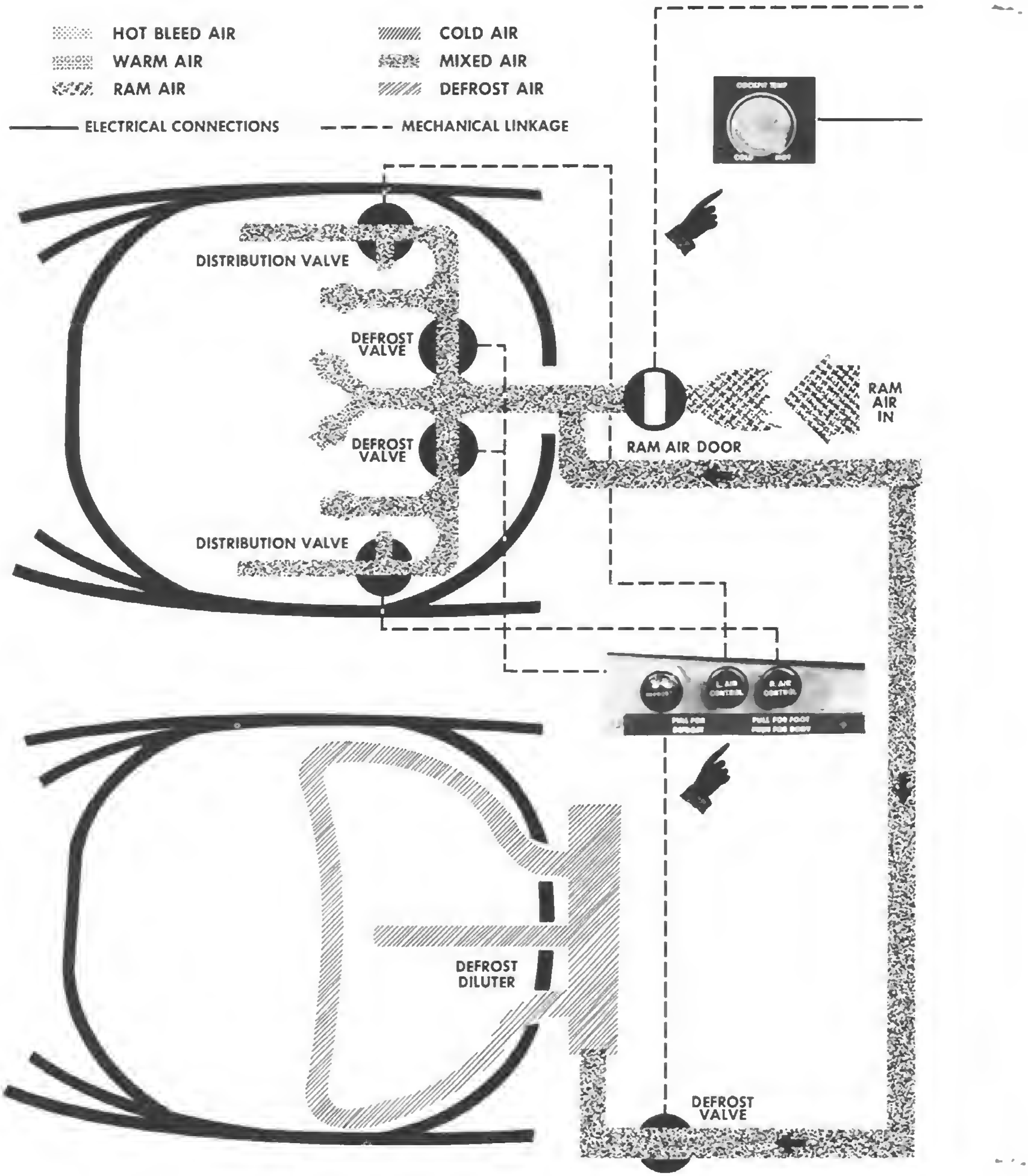


Figure 1-42 (Sheet 1 of 2)

AND DEFROSTING SYSTEM

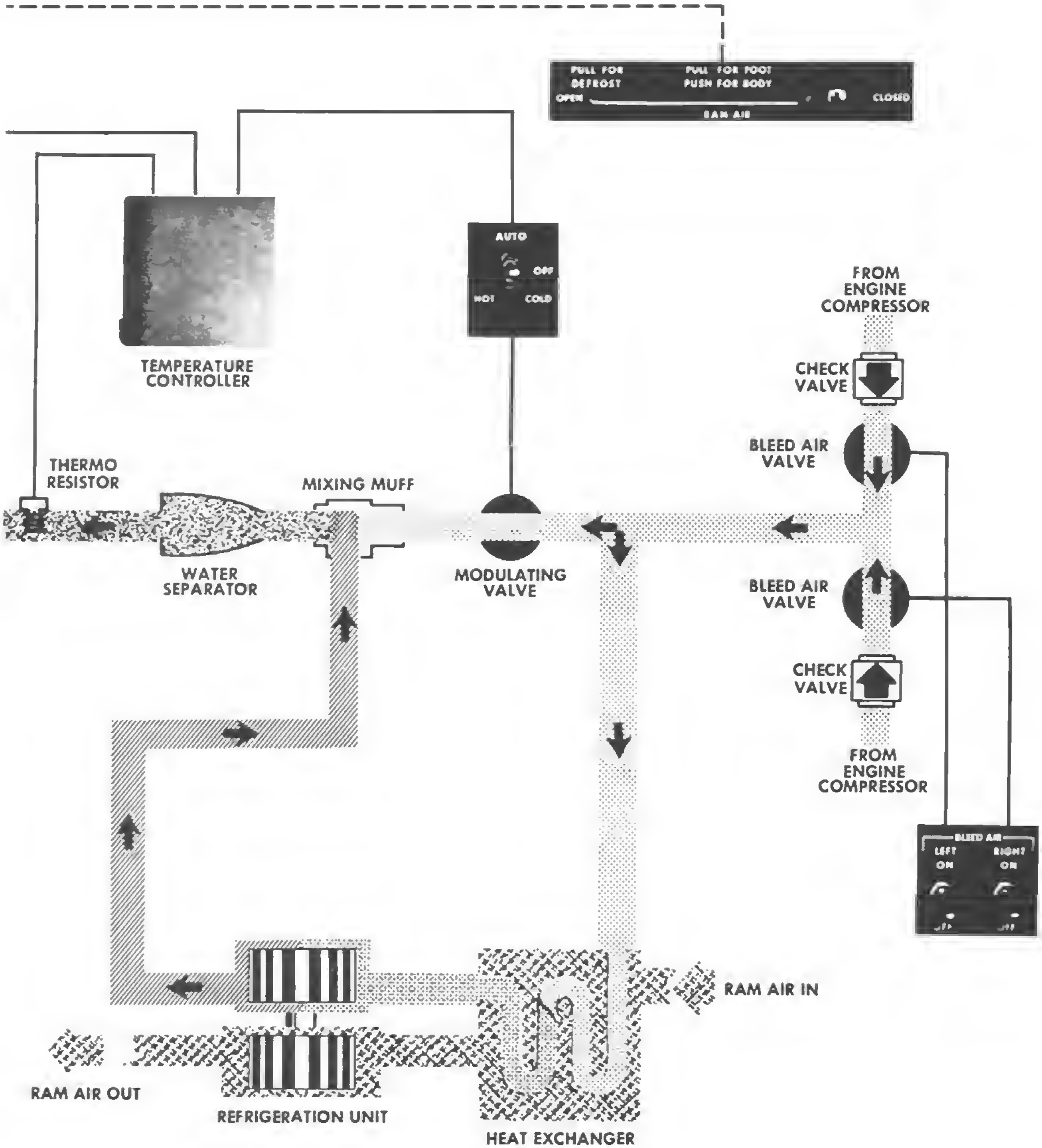


Figure 1-42 (Sheet 2 of 2)

COCKPIT AIR TEMPERATURE CONTROL RHEOSTAT

The rheostat (9, figure 1-41), controls cockpit air temperature and functions only when the cockpit air temperature switch is in the AUTOMATIC position and when ac power is available at the cockpit temperature control unit.

COCKPIT VENTILATION

Cockpit ventilation is provided through the ram air intake duct and uses the same outlets as the air conditioner. Cockpit ventilation may be selected any time that air conditioning is not desired or is malfunctioning. The temperature of the air will be the same as outside air temperature.

Ram Air Lever

If ram air is desired, position the ram air lever (3, figure 1-41) to the OPEN position. This opens the ram air system, allowing outside air to enter the cockpit through the same air outlets as used by the conditioned air. With the lever in the CLOSED position, ram air is shutoff. Both ram air and conditioned air should not be selected at the same time.

WARNING

> The ram air ventilation scoop shall be in the CLOSED position during all refueling operations. If an air conditioning failure has made ram air ventilation mandatory, the pilot should close the ram air scoop and go on oxygen during refueling operations.

Note

> The ram air lever should be in the CLOSED position during flights in rainy weather and while the aircraft is not in use to prevent the collection of water in the ram air valve.

Air Control Knob

The manually operated air control knobs (2, figure 1-41), labeled PUSH-BODY and PULL-FOOT, are located above the air conditioner panel. When either knob is pulled out, it directs conditioned air or ram air to the area just forward of the feet. With either knob pushed in, air is directed to the piccolo tubes. Either knob may be placed in any intermediate position to permit distribution of air from both outlets at the same time.

DEFROSTING SYSTEM

Conditioned air is also used for windshield and canopy defrosting. The air enters the defrosting system through a manually controlled defrost shutoff valve. Air is released from outlets along the bottom and center of either side of the windshield and on the forward edge of the canopy.

Windshield and Canopy Defrost Knob

The windshield and canopy defrost knob (1, figure 1-41), is below the canted instrument panel above the air conditioning panel. The amount of defrosting may be controlled by the forward-aft positioning of the defrost knob. The air conditioning outlets will increase or decrease flow by the forward-aft positioning of the defrost knob. The outlets on the center console will not be affected by this knob or its positioning.

Note

> The defrosting system should be operated at the highest temperature possible (consistent with the pilot's comfort) during high altitude flight in order to provide sufficient preheating of the windshield and canopy surfaces to preclude the formation of frost or fog during descent.

NORMAL OPERATION OF COCKPIT AIR CONDITIONING SYSTEM

1. Bleed air switches - ON.
2. Cockpit air temperature control switch - AUTOMATIC.
3. Cockpit air temperature control rheostat - To desired temperature.
4. Air control knob - To desired position.

OXYGEN SYSTEM

The oxygen system has two supply cylinders with an original charge pressure of 425 ±25 psi (full) and are located in the forward part of the tailcone. Two demand regulators are located on the lower outboard edges of the instrument panel. These regulators automatically control pressure and quantity to the pilot's face masks according to cockpit altitude requirements. A pressure gage and flow indicator are included as part of the regulator assemblies. A filler valve located on the upper left side of the tailcone aft of the wing provides a means for replenishing the supply from a ground source. Refer to servicing diagram, figure 1-51. Approximate duration of the oxygen supply is shown in figure 1-44.

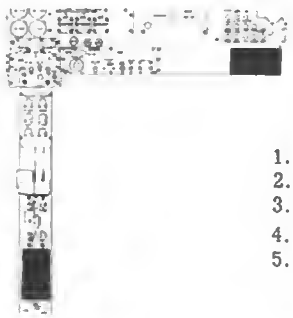
Note

> As the aircraft ascends to high altitudes, where the temperature is low, the oxygen cylinders become chilled. This may result in a rapid decrease in pressure. A rapid fall in oxygen pressure while the aircraft is in level flight, or while it is descending, is not necessarily due to falling temperature. When this happens, leakage or loss of oxygen must be suspected.

OXYGEN REGULATORS

The demand oxygen regulators (figure 1-43) mix air with oxygen in varying amounts according to cockpit altitude and deliver a quantity of mixture each time the users inhale. The regulators supply positive pressure breathing above approximately 28, 000 feet. The delivered pressure automatically changes with altitude.

OXYGEN REGULATORS



1. EMERGENCY LEVER
2. FLOW INDICATOR
3. DILUTER LEVER
4. PRESSURE GAGE
5. SUPPLY LEVER

Figure 1-43

OXYGEN SYSTEM REGULATOR LEVERS

Diluter Lever

Each oxygen regulator panel incorporates a diluter lever. The lever (3, figure 1-43) is located on the lower center of the regulator. This lever is used to select NORMAL OXYGEN or 100% OXYGEN. The lever in the NORMAL position allows the normal flow of oxygen to the mask at all altitudes. When the lever is at the 100% OXYGEN position, cockpit air is shutoff and only 100% oxygen enters the mask.

WARNING

Whenever an oxygen regulator is not used, the diluter lever for that regulator should be in the 100% OXYGEN position. This closes the mixer port on the regulator to keep it clean. In the 100% OXYGEN position with the supply lever OFF and the mask on, a breath cannot be drawn, thereby serving as an indication to place the supply lever to the ON position. With the supply lever in the OFF position and the diluter lever in the NORMAL OXYGEN position, air to the mask will come through the mixer port, but no oxygen will be mixed with it.

Emergency Lever

The emergency lever (1, figure 1-43) is located on the bottom left corner of the regulator panel and is labeled EMERGENCY, NORMAL and TEST MASK. The lever is a toggle-type, spring-loaded from the TEST MASK position only. When depressed to the TEST MASK position, positive pressure will be delivered to the mask; as soon as pressure is relaxed, the lever will automatically return to the NORMAL position. Positioning the lever to EMERGENCY causes continuous positive pressure to be delivered to the mask. Moving the lever to the NORMAL position, will return the system to normal operation.

CAUTION

When positive pressures are required, it is mandatory that the oxygen mask be well fitted to the face. Unless special precautions are taken to insure no leakage, continued use of positive pressure under these conditions will result in the rapid depletion of the oxygen supply.

Note

Oxygen masks can be tested at any altitude by placing the emergency lever to the test position.

Supply Lever

The supply lever (5, figure 1-43), is located on the bottom right side of each regulator. The lever has two positions, ON and OFF. When the lever is positioned ON, oxygen is permitted to enter the regulator, and in the OFF position, the oxygen supply is cut off.

WARNING

When flying SOLO, be sure the copilot's oxygen supply lever is in the OFF position and the diluter lever is in the 100% position. If left ON, oxygen could be lost at altitude.

OXYGEN SYSTEM REGULATOR INDICATORS

Pressure Gage and Flow Indicator

The oxygen pressure gage (4, figure 1-43) is located on the right portion of the regulator panel and the flow indicator (2, figure 1-43), is located to the left position of the regulator panel. As oxygen flows from the regulator, the flow indicator blinks. The indicator is white on some aircraft and black on others when not in use.

OXYGEN • duration chart– **HOURS** — 2 CREW MEMBERS

CABIN ALTITUDE FEET / GAGE PRESSURE (PSI)	400	350	300	250	200	150	100
25,000	3.08 **2.45**	2.63 **2.14**	2.31 **1.83**	1.96 **1.53**	1.54 **1.22**	1.15 **.91**	.77 **.61**
20,000	3.22 **1.87**	2.82 **1.63**	2.41 **1.39**	2.02 **1.16**	1.61 **.92**	1.20 **.69**	.80 **.46**
15,000	4.24 **1.49**	3.71 **1.31**	3.17 **1.12**	2.65 **.93**	2.12 **.75**	1.58 **.56**	1.06 **.37**
10,000	5.63 **1.20**	4.94 **1.05**	4.21 **.89**	3.52 **.75**	2.80 **.60**	2.10 **.45**	1.41 **.29**

EMERGENCY BELOW 100 PSI DESCEND TO ALTITUDE NOT REQUIRING OXYGEN

- LIGHT FIGURES INDICATE DILUTER LEVER - NORMAL
- BOLD FIGURES INDICATE DILUTER LEVER - 100%
- DURATION IS DOUBLED FOR ONE CREW MEMBER

Figure 1-44

OXYGEN HOSE HOOKUP

Proper attachment of the oxygen mask hose and connector is extremely important to assure that:

1. The oxygen hose does not become accidentally disconnected during flight resulting in loss of oxygen supply to a crew member.
2. The oxygen hose does not prevent quick separation from the seat during ejection.
3. The oxygen hose does not whip during ejection causing injury to the crew member.

WARNING

> The oxygen hose from the mask to the quick disconnect should be routed under the right shoulder harness. This helps keep the shoulder harness clear of the connector and prevents the harness from being snagged between the connector and its mounting plate during seat separation.

4. On aircraft ▲1, an oxygen hose restraint strap (11A, figure 1-3) is installed to restrain the oxygen hose from obstructing the pilot's view of the oxygen regulator or the ADF radio control. When the oxygen hose restraint strap is used, it is possible to inadvertently change the position of either the emergency lever or diluter lever of the pilot's oxygen regulator. For this reason, do not restrain the pilot's oxygen hose with the oxygen hose restraint strap. On aircraft ▲2, the oxygen hose restraint strap has been removed.

CRU-60/P CONNECTOR

The following procedures shall be employed in hooking up the oxygen supply system through the CRU-60/P multi-directional quick-disconnect. (See figure 1-45.)

1. Insert connector into the mounting plate attached to the parachute harness. Check that the connector is firmly attached and that the lock pin is locked.
2. Insert male bayonet connector, on the end of the oxygen mask hose, into the female receiving port of the CRU-60/P connector. Turn bayonet connector to lock prongs into the recess in the lip of receiving port.
3. Couple the regulator oxygen hose to the lower port of the connector.
4. Attach the bailout bottle hose (if available), to the swiveling port of the connector by inserting the male coupling of the bailout bottle hose and turning it clockwise against the spring-loaded collar.

OXYGEN SYSTEM PREFLIGHT CHECK

See figure 1-45 for the correct method of oxygen hose attachment. Both crew members should complete the following preflight check.

P - PRESSURE - The pressure gage should read 425 ±25 psi and should agree approximately with the other regulator pressure gage.

R - REGULATOR - Check Regulator ON. Hook-up your mask and perform a pressure check. Place the emergency lever to the EMERGENCY position, take a deep breath and hold it. If mask leakage occurs, readjust mask and reaccomplish the check. The oxygen should stop flowing. If the mask appears to be properly fitted, but the oxygen continues

▲1 AIRCRAFT 69-6388 AND ON AND AIRCRAFT 67-14776 THRU 69-6387 WHEN MODIFIED PER T.O. 1A-37B-524.

▲2 AIRCRAFT 70-1292 AND ON AND AIRCRAFT 67-14776 THRU 70-1291 WHEN MODIFIED PER T.O. 1A-37B-554.

OXYGEN HOSE HOOKUP CRU 60/P CONNECTOR

1. INSERT CONNECTOR INTO THE MOUNTING PLATE ATTACHED TO THE PARACHUTE HARNESS. CHECK THAT THE CONNECTOR IS FIRMLY ATTACHED AND THAT THE LOCK PIN IS LOCKED.
2. INSERT MALE BAYONET CONNECTOR ON THE END OF THE OXYGEN MASK, INTO THE FEMALE RECEIVING PORT OF THE CRU-60/P CONNECTOR. TURN BAYONET CONNECTOR TO LOCK PRONGS INTO THE RECESS IN THE LIP OF RECEIVING PORT.
3. COUPLE THE OXYGEN REGULATOR HOSE TO THE LOWER PORT OF THE CONNECTOR.
4. ATTACH THE BAILOUT BOTTLE HOSE (IF AVAILABLE) TO THE SWIVELING PORT OF THE CONNECTOR BY INSERTING THE MALE COUPLING OF THE BAILOUT BOTTLE HOSE AND TURNING IT CLOCKWISE AGAINST THE SPRING-LOADED COLLAR.

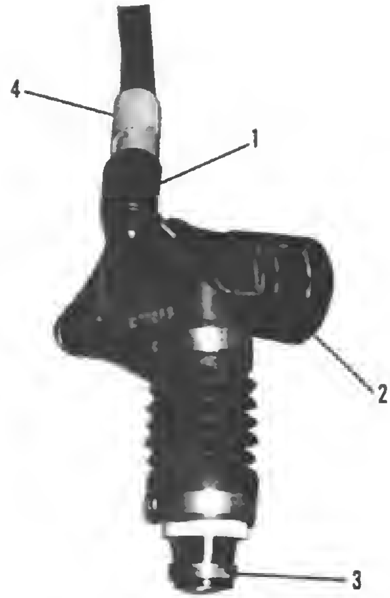


Figure 1-45

flowing, the regulator, hose, or valve is not holding pressure and cause of the leak should be corrected. Return the emergency lever to NORMAL. If you cannot exhale, the valve is obstructed, defective, or improperly seated and should be corrected or replaced.

I - INDICATOR - With the diluter lever in 100% OXYGEN position, check blinker for proper operation.

C - CONNECTIONS - Check regulator hose connection secure at the connector. Check regulator hose for kinks, cuts or cover fraying. Check that male part of the quick-disconnect is not warped and the rubber gasket is in place. A 10 to 20 pound pull should be required to separate the two parts. Check mask hose properly installed to connector.

E - EMERGENCY - Check bailout bottle (if used) properly connected and a minimum pressure of 1800 psi. (Pressure gage must be checked during parachute preflight.)

OXYGEN SYSTEM NORMAL OPERATION

1. Before each flight, be sure oxygen pressure gage indicates 425 ±25 psi. If pressure is low, have the oxygen system charged to capacity before takeoff.
2. Diluter lever - NORMAL OXYGEN.
3. Supply lever - ON.
4. Emergency lever - NORMAL.

OXYGEN SYSTEM EMERGENCY OPERATION

In the event either pilot detects symptoms of nausea, proceed as follows:

1. Emergency lever - EMERGENCY.
2. Descend.
3. When it is evident that an emergency condition no longer exists return emergency lever to NORMAL OXYGEN.

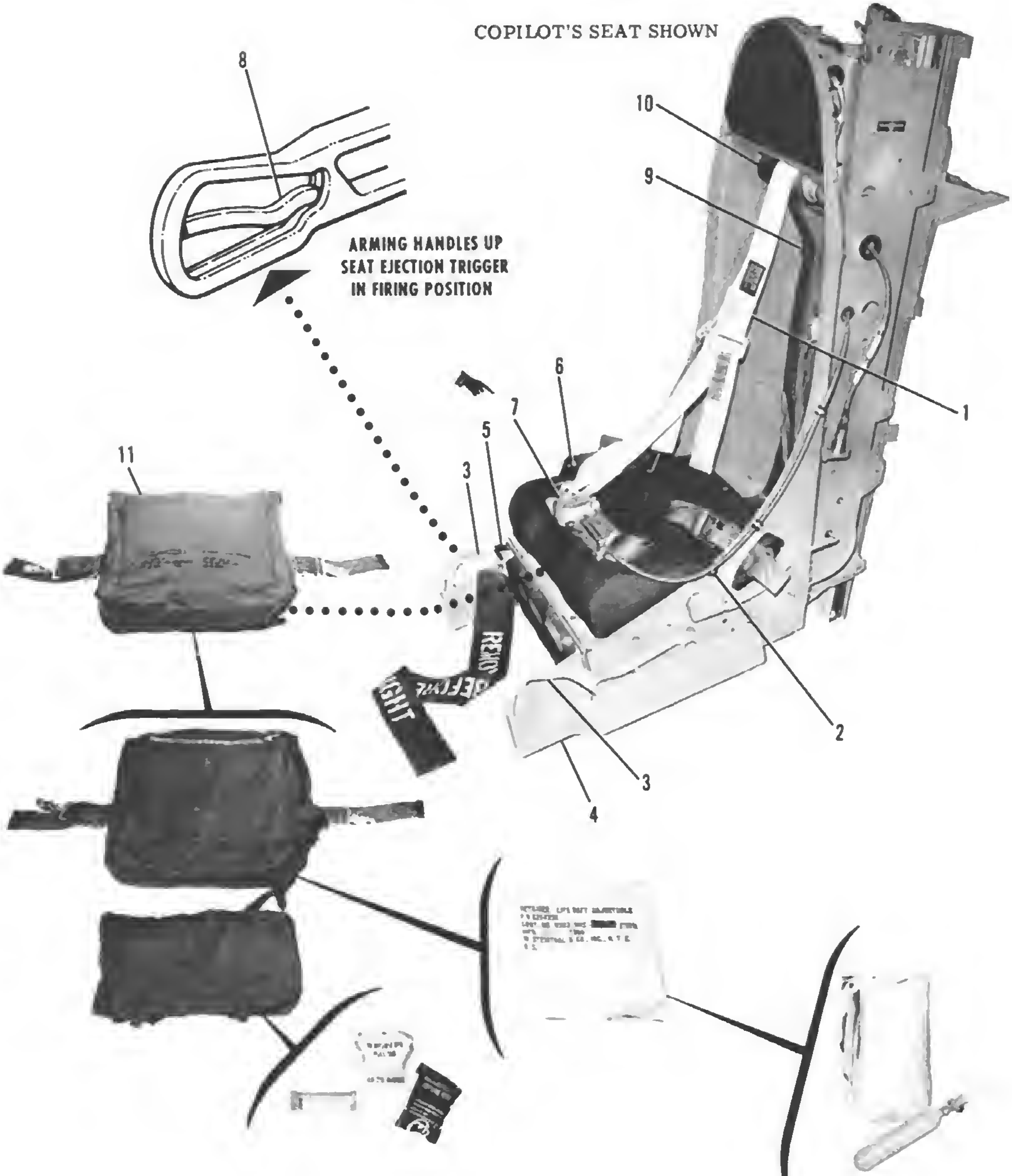
WARNING

- In the event of regulator failure, or a leaking mask or hose, positioning the emergency lever to the EMERGENCY position will bypass the regulator and supply the user with positive oxygen pressure. A descent to an altitude not requiring oxygen should be made immediately if such a malfunction should occur.
- Oxygen supply is rapidly reduced when either or both crew members demand 100% oxygen or when the emergency lever is held in the EMERGENCY position.

<u>EJECTION SEATS</u>

Ejection seats (figure 1-46), are installed in the aircraft. The ejection seats will catapult the occupants clear of the aircraft at any speed, altitude, or attitude. A catapult fired by a ballistic charge supplies the necessary force to eject the seat and occupant upward from the aircraft. Each seat accommodates a back-type parachute, and is provided with an inertia reel-type shoulder harness, an automatic opening

EJECTION SEAT



1. SHOULDER HARNESS
2. SHOULDER HARNESS LOCKING LEVER
3. ARMING HANDLE
4. ARMING HANDLE GUARD
5. ARMING HANDLE SAFETY PIN
6. SEAT ADJUSTMENT
7. SAFETY BELT
8. SEAT EJECTION TRIGGER
9. EJECTION SEAT STRAP GUIDE
10. SEAT-MAN SEPARATOR
11. SURVIVAL KIT (REPLACES SEAT CUSHION)

Figure 1-46

safety belt, a seat-man separator, and a canopy cutter. Each seat is manually adjusted up or down by actuating a seat adjustment lever (6, figure 1-46) to release the seat adjustment catches. Each seat has an emergency disconnect unit on the lower left side that contains the balistic leads that automatically disconnect at the time of seat ejection. The communications lead and oxygen hose have in-line connectors that separate during seat ejection.

WARNING

- Ground safety pins are inserted above the right arming handle of each seat and the canopy initiator on the left side of the cockpit, when the aircraft is on the ground and during maintenance operations, and are removed before takeoff. If the pins are left in place, canopy jettisoning and seat ejection are prevented on that seat.
- The arming handle safety pins do not safety the canopy jettison system if the canopy jettison T-handle is pulled.
- It is necessary to check that the seat catches have engaged after a seat has been adjusted up or down. If the catches are not engaged, the seat may not eject from the aircraft during ejection, or may inadvertently move during flight.
- Before lowering seat, check area for objects that would prevent the arming handles from lowering with seat, resulting in jettisoning of canopy and arming of the seat.
- Do not use any additional seat cushions except those which are furnished with the aircraft. If additional seat cushions are used, and if ejection becomes necessary, serious spinal injuries can result when the ejection force compresses the cushions, enabling the seat to gain considerable momentum before exerting a direct force on the pilot or copilot. Chance of injury during forced landing is also increased.
- After canopy has been jettisoned, purposely or otherwise, and seat ejection has not been accomplished, no attempt should be made to place the arming handles back down. The arming handles are held in the up position by means of a mechanical lock. In the event of damaged firing devices, any movement of the arming handles or trigger might jettison the seat with possible injury to the person attempting such action.

EJECTION SEAT ARMING HANDLES

When the arming handles (3, figure 1-46) are raised to the full up position they lock in the up position exposing the seat ejection trigger, locking the shoulder harness, and jettisoning the canopy. The linkage is such that both arming handles are interconnected and will raise together.

SEAT EJECTION TRIGGER

The seat ejection trigger (8, figure 1-46) is located within the ejection seat right arming handle on each seat and is accessible only when the arming handles are in the full up position. Squeezing the trigger fires an initiator. The expanding gases produced are routed to the seat catapult which ejects the seat.

WARNING

Check to make sure trigger is clear for actuation.

SHOULDER HARNESS LOCKING LEVER

The locking lever (2, figure 1-46) with LOCKED and UNLOCKED positions provides for manual control of the shoulder harness locking feature. A latch is provided for positively retaining the lever at either position on the quadrant. When the shoulder harness is not manually locked, an inertia reel will automatically lock it when a sudden deceleration force of approximately two to three G's is applied. If the locking lever is placed in the LOCKED position while the occupant is leaning forward, the inertia reel will automatically retract slack harness with each aft movement of the occupant until the fully retracted position has been reached. After automatic locking of the shoulder harness, it will remain locked until the lever is moved to the LOCKED position and back into the UNLOCKED position.

SEAT-MAN SEPARATOR

A seat-man separator (10, figure 1-46) on each seat provides automatic and positive separation of the seat and occupant after ejection from the aircraft. The separator is actuated by a one-second delay initiator mounted on the seat back. After ejection, the separator, actuated by the initiator, winds-up the strap attached to the separator and seat bottom, separating the seat and occupant.

AUTOMATIC OPENING SAFETY BELTS AND AUTOMATIC OPENING PARACHUTES

AUTOMATIC OPENING SAFETY BELTS

In order to provide a quick, sure and dependable separation from the seat after ejection, an automatic safety belt release mechanism is incorporated in each ejection seat. The system consists of a trigger, a safety belt release initiator, necessary ballistics

tubing, and an automatic opening safety belt, (figure 1-47). The safety belt initiator is triggered by the seat as it leaves the aircraft; after a one-second delay, the initiator fires and the expanding gas operates the safety belt automatic opening mechanism. Upon automatic opening of the belt, only the shoulder harness will be released; the parachute arming lanyard will be securely attached to the safety belt and to the seat, leaving the occupant free to separate from the seat. The automatic opening feature of the parachute is activated by the occupant's separation from the seat. Figure 1-47 shows the automatic opening safety belts in the locked, manually opened, and automatically opened conditions. If the safety belt is opened manually the parachute arming lanyard anchor will not be retained to pull the parachute arming lanyard.

WARNING

Do not open the automatic safety belt prior to ejection, regardless of altitude. Since the deceleration of a crew member alone is considerably greater than that of the crew member and seat together, immediate separation would result if the safety belt were manually opened prior to ejection. This could result in the parachute pack being blown open and injuries caused by a high opening shock of the parachute.

TYPE HBU-2B/A AUTOMATIC-OPENING SAFETY BELTS

The HBU-2B/A automatic-opening safety belt (figure 1-47) has an improved design buckle assembly to prevent inadvertent opening of the belt. Release of this belt is accomplished either by manual rotation of the rotary mechanism on the belt or by gas pressure from an automatically controlled initiator. The initiator supplies gas pressure through a high pressure hose that opens the belt latch release mechanism. Full manual counterclockwise rotation of the serrated spring-loaded manual release handle releases the lanyard anchor and the belt link. The parachute arming lanyard anchor is inserted into the V-shaped opening at the top of the belt buckle (lanyard latch). Before the belt can be fully locked, the parachute arming lanyard anchor must be inserted and locked into the lanyard latch. It is mechanically impossible to fasten the belt link unless the parachute arming lanyard anchor has been properly locked in the lanyard latch. Gas pressure actuation of the automatic release mechanism releases the right hand belt link from the belt latch but retains the parachute arming lanyard anchor. The lanyard anchor remains locked in the latch mechanism during automatic opening and can be released only manually. Figure 1-47 shows the HBU-2B/A in the locked condition with shoulder harness and parachute arming lanyard anchor attached, the automatic opening conditon, and the manual opening condition. Manual operation of the automatic belt can over-ride the automatic function at any time. When flying solo, the right seat HBU-2B/A belt is secured by tripping the parachute arming lanyard latch and then securing the belt harness and oxygen hose in the normal manner.

WARNING

If the automatic opening safety belt is opened manually, the automatic parachute release will not be actuated unless the parachute arming knob is pulled.

SAFETY BELT

AUTOMATIC OPENING TYPE

TYPE HBU-2B/A BELT

TO LOCK THE SAFETY BELT, PROCEED AS FOLLOWS:

1. Insert the anchor (gold key) from the arming lanyard in the lanyard latch. An audible click may be heard as the lanyard latch locks. Pull on the anchor to check that the lanyard is locked.

WARNING

Lanyard must be outside parachute harness and not fouled on any equipment to permit clean separation from the seat.

Note

The arming lanyard must be inserted and locked in the lanyard latch first or the belt link will not lock in the belt latch.

2. Insert the belt link through the loops of the shoulder harness and into the belt latch. An audible click may be heard as the belt latch locks. Pull on the belt link to check that the belt is locked.

AUTOMATIC OPERATION OF THE SAFETY BELT IS AS FOLLOWS:

1. Automatic operation is accomplished one second after ejection from the aircraft when the seat belt initiator fires and gas pressure is directed to the buckle assembly through the initiator hose. The seat belt latch is opened, releasing the shoulder harness (manual release handle does not rotate). The arming lanyard remains locked in the lanyard latch. As the crewmember is separated from the seat by the seat-man separator, the arming lanyard is pulled.

TO MANUALLY UNLOCK THE SAFETY BELT, PROCEED AS FOLLOWS:

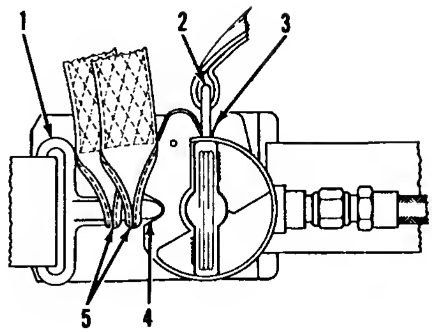
1. Rotate the release handle fully counterclockwise. The arming lanyard anchor and the belt link are unlocked and released from the buckle assembly.

WARNING

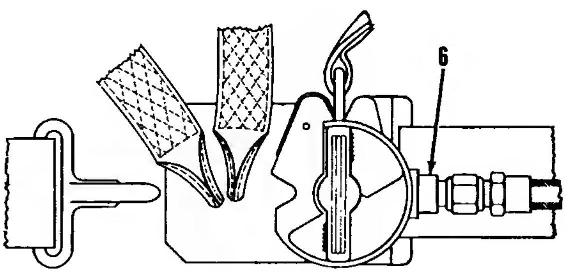
Under no circumstances should the safety belt be manually opened before ejection, regardless of the altitude.

Note

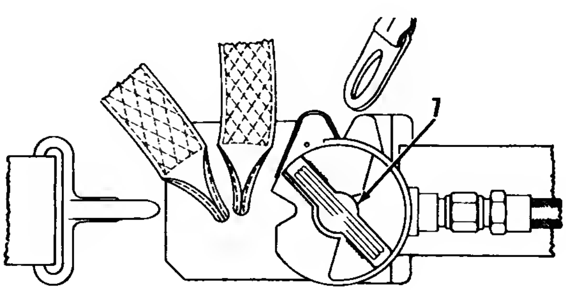
Manual operation of the automatic belt can override the automatic function at any time.



1. BELT LINK
2. ANCHOR (GOLD KEY)
3. LANYARD LATCH
4. BELT LATCH
5. SHOULDER HARNESS



6. INITIATOR HOSE



7. RELEASE HANDLE

Figure 1-47

AUTOMATIC OPENING PARACHUTES

The ejection seats are designed to utilize a back-type automatic opening parachute. Automatic release from the seat following ejection and automatic opening of the parachute results in safer and quicker deployment of the parachute. In order to accomplish automatic opening, the parachute is equipped with an automatic ripcord release mechanism. An aneroid device and timer are incorporated in the release mechanism to pull the rip cord when the preset altitude is reached. The parachute timer is set for a number of seconds delay. The aneroid device is set according to instructions contained in applicable technical publications, and as aircraft flight areas dictate. The chain of events in the release mechanism is activated by the parachute arming lanyard which is attached to the automatic opening safety belt by a metal parachute arming lanyard anchor for automatic operation. An orange knob is attached to the parachute arming lanyard for manual operation. Upon separation from the seat, the parachute arming lanyard remains attached to the safety belt thus activating the ripcord release mechanism. When activated above the preset altitude, the parachute will remain closed until the preset altitude is reached, then open. When the release mechanism is activated below the preset altitude, the parachute will open after the number of seconds delay set on the timer. The parachute is equipped with a parachute ripcord handle for opening the parachute manually.

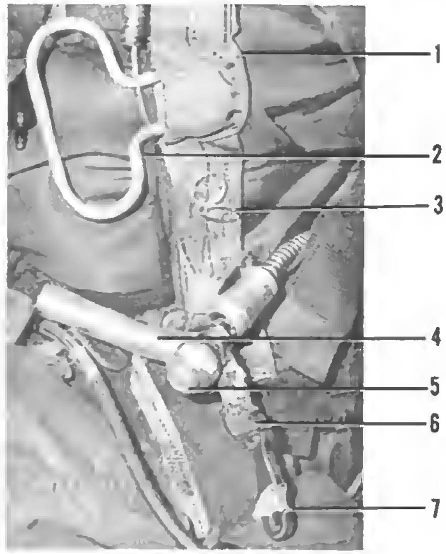
WARNING

- For automatic parachute deployment:
  1. The automatic safety belt initiator pin must be removed.
  2. The parachute arming lanyard anchor must be fastened to the safety belt.
  3. The safety belt must open automatically.
- If any one of the above conditions is not met the parachute arming knob must be pulled for automatic parachute deployment.

Note

- The automatic opening parachute can be opened manually at any time by pulling the parachute ripcord handle.
- If it is necessary that either the parachute ripcord handle or the parachute arming knob be pulled to open the parachute, use the parachute ripcord handle if below 14, 000 feet and the parachute arming knob if above.

ONE AND ZERO EJECTION SYSTEM



1. PARACHUTE HARNESS
2. PARACHUTE RIPCORD HANDLE
3. STOWAGE RING
4. PARACHUTE ARMING LANYARD
5. PARACHUTE ARMING LANYARD KNOB
6. ZERO DELAY LANYARD
7. ZERO DELAY LANYARD HOOK

Figure 1-48

ONE AND ZERO SYSTEM

In order to provide an improved low altitude escape capability, a system incorporating a one-second safety belt delay and a zero-second parachute delay ("one and zero" system) is provided for ejection seat escape. This system (figure 1-48) makes use of a detachable zero delay lanyard attached to the parachute arming knob. When the hook on the other end of the zero delay lanyard is attached to the parachute ripcord handle, the automatic timer is by-passed and, upon separation from the seat after ejection, the parachute ripcord handle is pulled immediately without any delay. A stowage ring is provided to stow the hook when it is not attached to the parachute ripcord handle. At altitudes of 10,000 feet pressure altitude or less the zero delay lanyard must be hooked to the parachute ripcord handle to provide parachute actuation immediately after separation from the ejection

seat. At altitudes above 10, 000 feet pressure altitude or at high airspeeds the zero delay lanyard must be disconnected from the parachute ripcord handle, and stowed thus allowing the parachute timer or the aneroid device to actuate the parachute.

Before takeoff the zero delay lanyard must be hooked to the parachute ripcord handle, after takeoff the zero delay lanyard manually remains connected below 10, 000 feet pressure altitude including flights in which 10, 000 feet pressure altitude may be temporarily exceeded.

Before penetration or passing 10, 000 feet pressure altitude during descent, the zero delay lanyard, should be hooked up. After landing it is not necessary to disconnect the zero delay lanyard from the parachute ripcord handle since it connects the parachute ripcord handle to the parachute arming lanyard knob and is not attached to the safety belt. The minimum emergency ejection altitude paragraph in Section II will determine the emergency minimum altitude for successful ejection. The "one and zero" system has been successfully flight tested at speeds between 120 KIAS and the maximum safe parachute opening speeds.

WARNING

- Since use of the parachute ripcord handle will open the parachute without delay, no time is allowed for slow down before the parachute opens; therefore, the zero delay lanyard should never be attached to the parachute ripcord handle during operations at high altitudes or airspeeds in order that the safety-delay provided by the parachute timer and aneroid devices will not be overridden.
- When disconnected insure that the lanyard hook is properly stowed in the ring.
- The emergency minimum ejection altitudes specified for one second safety belt and zero-second parachute setting apply when the zero delay lanyard is attached to the parachute ripcord handle and the parachute arming lanyard anchor is attached to the automatic opening safety belt.

Refer to Section III for additional information and seat ejection procedures.

MISCELLANEOUS EQUIPMENT

MAP AND DATA CASE

A map and data compartment is provided on both sides of the cockpit. This map and data compartment is a part of the upholstery. A box in the right-hand nose section is also provided for safety pin storage.

REAR VISION MIRROR

Adjustable rear-vision mirrors are mounted on the inner surface of the canopy just aft of the canopy bow. Mirrors are provided for both the pilot and copilot's side of the canopy.

CANOPY BREAKER ESCAPE TOOL

A canopy breaker knife is mounted in a bracket on the canopy bow. The knife can be used for cutting through the canopy during an emergency, whenever the canopy fails to jettison. The canopy breaker knife is shown in figure 1-49, along with the proper way of holding the knife. When using the knife make sure that the curved edge of the knife is toward the person using it, this will prevent the knife from glancing off the canopy and causing possible injury to the user.

SURVIVAL KIT

Each ejection seat is equipped with a survival kit which contains a life raft, dye marker, shark repellent and two flares. The kit is padded and is used in lieu of a seat cushion.

CANOPY BREAKER

Figure 1-49

SERVICING DIAGRAM

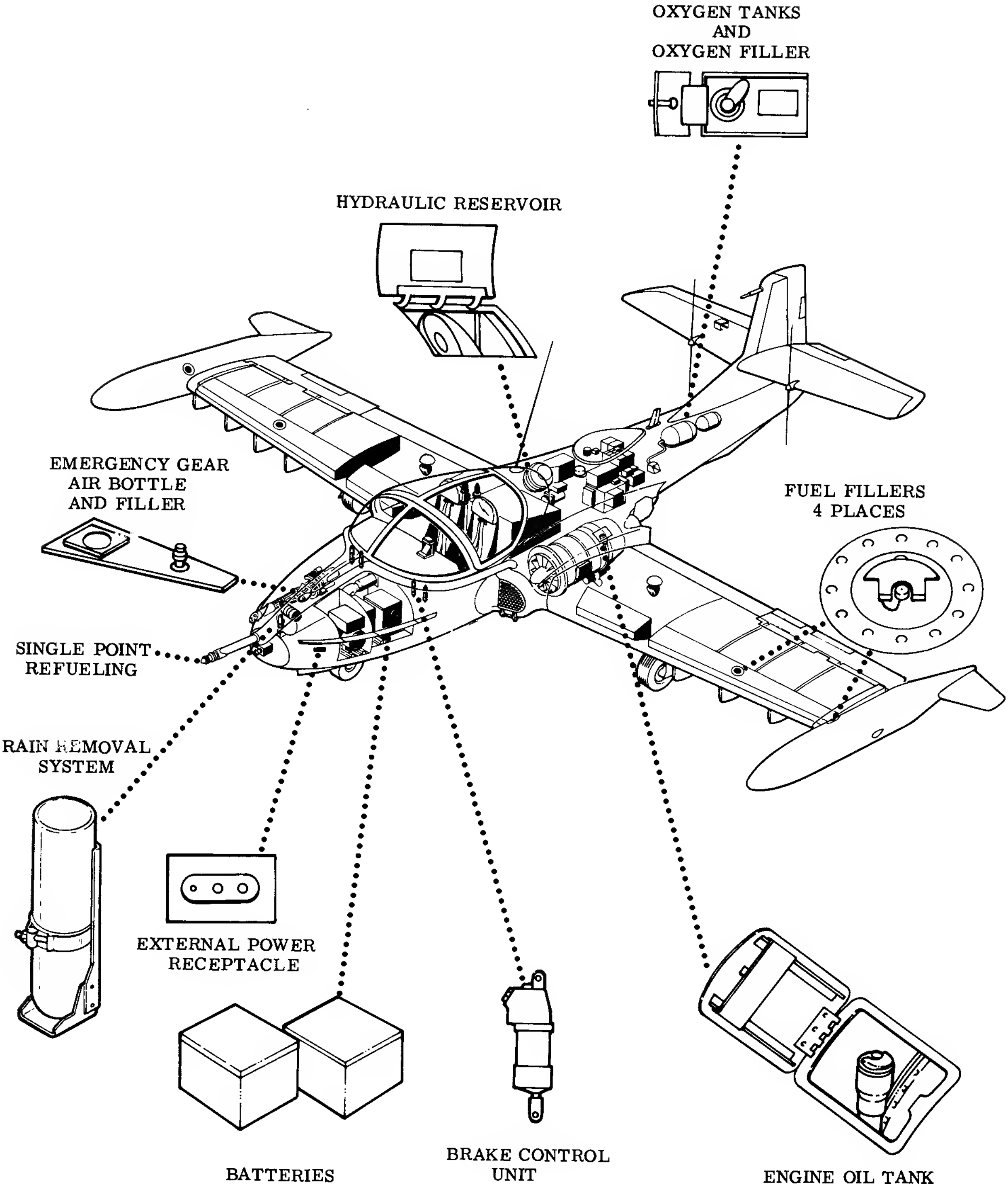


Figure 1-50

SERVICING CHART

GRADE	MIL SPEC	COMMERCIAL DESIGNATION	NATO SYMBOL	FREEZE POINT
		FUEL		
JP-4	MIL-T-5624		F-40	-72°F
		ALTERNATE FUEL		
....	....	Jet B	F-40	-56°F
JP-5	MIL-T-5624	......	F-44	-51°F
....	....	Jet A-1	F-34	-54°F
....	....	Jet A*	F-30	-36°F
115/145	MIL-G-5572	Avgas**	F-22	-76°F
		HYDRAULIC FLUID		
....	MIL-H-5606	......	H-515	......
		OIL		
....	MIL-L-007808F	......	O-148	......
		OXYGEN		
....	MIL-O-27210	......	.....	......

RAIN REMOVAL SYSTEM

RAIN REMOVAL PRESSURIZED FLUID CONTAINER 65-38196-2

*When used, do not fly at altitudes at which -36°F can be anticipated.

**When used, add 3% lubricating oil (MIL-L-22851 or equivalent) to fuel tanks prior to fueling with aviation gasoline.

Note

- No performance retardation will be experienced when using any of the above jet fuels. When using aviation gas, a 2% increase in specific fuel consumption and corresponding reduction in range can be expected.
- It is recommended, when prolonged use of an alternate fuel is anticipated, that the engine fuel density control be properly adjusted for the fuel being used.

Figure 1-51

SECTION II NORMAL PROCEDURES

TABLE OF CONTENTS

PREFLIGHT CHECK

The exterior inspection will be influenced to some extent by the type of operation encountered, i.e. cold weather, hot weather, etc. Refer to Section VII for additional weather information. During normal operation, proceed as follows:

BEFORE EXTERIOR INSPECTION

1. Nose gun safing pin - CHECK installed ▲.
2. Safety pins - CHECKED.
   a. Canopy jettison T-handle - INSTALLED.
   b. Seat arming handles - INSTALLED.
   c. Canopy actuator firing head - REMOVED.
3. Handgrips and triggers - CHECK.
4. Seat-man separator - CHECK for cuts and frays, strap in strap guide.
5. Tubing and hose fittings - CHECK.
6. Form 781 - CHECKED for status, exceptional release, fuel, oxygen, oil and remarks pertaining to the condition of the aircraft.
7. Electrical power - OFF.
8. Oxygen quantity - CHECK.
9. Bob weight scale - CHECK for proper position.
10. Publications - CHECK.

▲ AIRCRAFT 70-1280 AND ON AND AIRCRAFT 67-14776 THRU 70-1279 WHEN MODIFIED PER T.O. 1A-37-523.

EXTERIOR INSPECTION

The pilot's exterior inspection procedures are based on the fact that maintenance personnel have completed all requirements of the Technical Manual of Inspection Requirements for preflight and postflight. Duplicate inspections by the pilot have been eliminated except for certain items required in the interest of flight safety. The aileron boost tabs are checked by deflecting the aileron by hand, up and down to its travel stop; as the aileron moves toward the stop the tab should show some deflection; as the aileron reaches the stop the tab will deflect quite noticeably. During the walk around inspection, the aircraft should be checked for general condition, access doors and filler caps secured, and for hydraulic, oil, and fuel leaks as well as for the following safety check items.

1. Canopy control switch - INTERNAL.
2. Gear safety pins - REMOVED.
3. Nose gear torque link safety pin - INSTALLED.
4. Engine intakes - CLEAR.
5. Tires - CONDITION.
6. External loads - CHECK.
7. Fuel tanks - CHECK QUANTITY.

RIGHT SEAT CHECK (SOLO FLIGHTS)

1. Circuit breakers - CHECK.
2. Map and data case - CHECK.
3. Seat arming handle safety pin - INSTALLED.
4. Shoulder harness, oxygen hose, radio cord, and seat belt - SECURE.
5. Oxygen supply lever - OFF.
6. Oxygen diluter lever - 100% OXYGEN.

COCKPIT CHECK (ALL FLIGHTS)

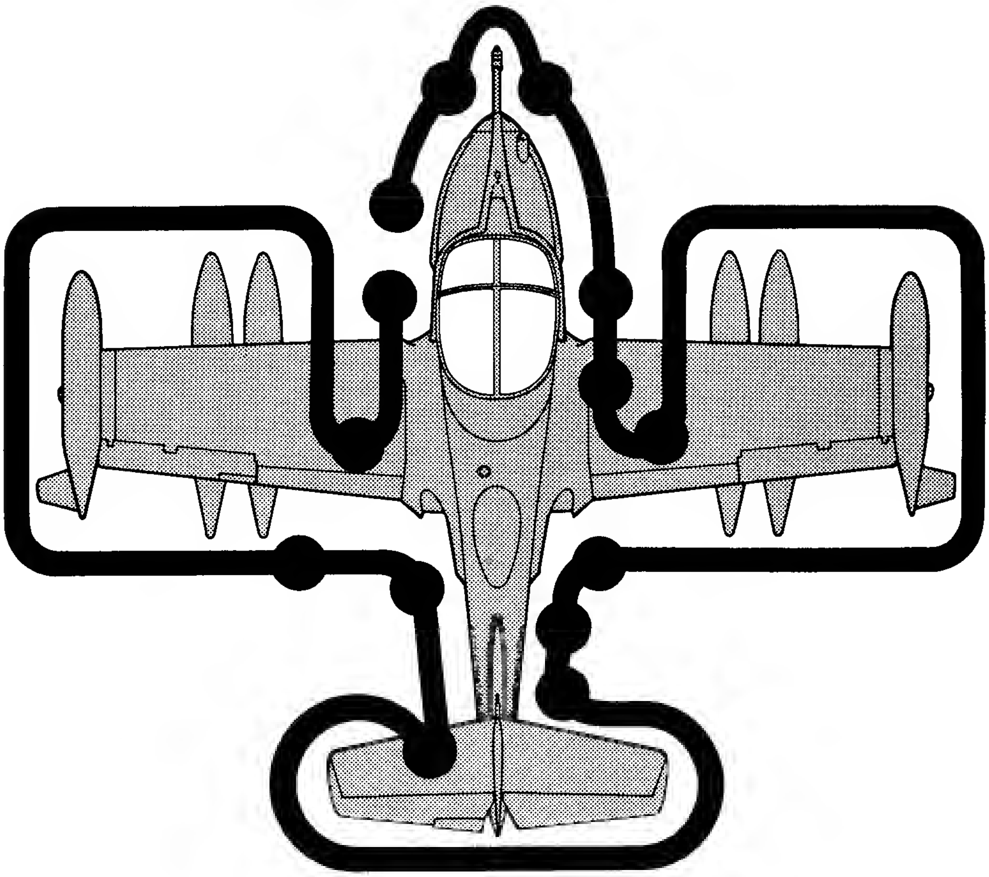
General
1. Survival kit - CONNECT.
2. Seat belt, shoulder harness and parachute arming lanyard - FASTENED and ADJUSTED.

WARNING

To permit clean separation from the seat during ejection, the parachute arming lanyard must be outside the parachute harness and not fouled on equipment.

3. Oxygen system - PRICE CHECK.
4. Oxygen and radio leads - CONNECT.
5. Zero-delay lanyard hook - CONNECT.

EXTERIOR INSPECTION



STARTING AT THE FORWARD LEFT SIDE OF THE AIRCRAFT PERFORM THE EXTERIOR INSPECTION AS OUTLINED IN THE TEXT IN ADDITION TO CHECKING THE AIRCRAFT SURFACES FOR WRINKLES, DENTS, LOOSE RIVETS, OIL, FUEL OR HYDRAULIC LEAKS, AND ACCESS DOORS AND PLATES FOR SECURITY.

Figure 2-1

6. Seat - ADJUST.

WARNING

- Check arming handles safety pin installed and area under seat clear of foreign objects before lowering seat to prevent inadvertent canopy jettison.
- After adjusting seat to proper height, check that adjustment lever is locked. If seat is not locked, G-loads in-flight may cause it to move, or prevent safe ejection. To check locked, attempt to move seat up and down.

7. Rudder pedals - ADJUST.
8. Control lock - STOWED.
9. Flight controls - CHECK.

Cockpit Left Side

1. Map and data case - CHECK.
2. Intercom controls - AS DESIRED.
3. Ground arm switch - OFF.
4. Antenna switches - AUTO.
5. X-band beacon switch - OFF.
6. Flap handle - UP.
7. Speed brake switch - IN.
8. Throttles - CUT-OFF.

Cockpit Front

1. IFF, TACAN, UHF - OFF.
2. Landing gear lever - DOWN.

CAUTION

Physically check the landing gear lever is full down.

3. Landing and taxi light switch - OFF.
4. Ignition switch - NORMAL (cover closed).
5. Gunsight light control - OFF.
6. All armament switches - OFF.
7. Pylon program switches - PROPERLY SET ▲.
8. Armament circuit breaker(s) - IN.
9. Rounds counter - SET.
10. Nose gun rate switch - AS DESIRED.
11. Compass slave switch - IN.
12. Attitude erection switch - NORMAL.
13. Clock - SET.
14. Air refueling switch - OFF.
15. Compass light switch - OFF.
16. Fuel shutoff handles - PUSH-ON.
17. Fuel selector switch - WING.
18. Fuel gaging selector switch - TOTAL ▲.
19. Tip tank switches - OFF.
20. Fuel system switch - GRAVITY.

CAUTION

If the fuel system switch is placed in the NORMAL position and the float switch located in the fuselage fuel tank is stuck, the fuel proportioner pump will operate continuously when electrical power is applied to the aircraft. If the engines are not running, the fuel proportioner pump can supply enough pressure to damage the fuselage fuel tank.

21. Stand-by attitude indicator - CAGED.

Note

To avoid damage to caging mechanism, pull cage knob out slowly.

22. Air conditioning controls - AS DESIRED.
   a. Cockpit air temperature control switch - AUTO.
   b. Cockpit air temperature control rheostat - AS DESIRED.
   c. Defrost knob - IN.
   d. Air control knobs - AS DESIRED.
   e. RAM air lever - AS DESIRED.
   f. Bleed air switches - ON.
   g. Anti-ice inlet - OFF.
23. Pitot heat switch - OFF.
24. VHF/FM, KY-28 - AS DESIRED.
25. Exterior lights switch - OFF.
26. Anti-collision beacon switch - OFF.
27. Inlet screen switch - AUTO.
28. Inverter switch - OFF.
29. Yaw damper switch - OFF.
30. Generator switches - ON.
31. Battery switch - OFF.
32. Landing gear emergency T-handle - IN.

Cockpit Right Side

1. Intercom controls - AS DESIRED.
2. Circuit breakers - IN.

Cockpit Center Pedestal

1. Interior light switches - OFF.
2. ADF - OFF.

ELECTRICAL POWER ON

1. Battery switch - ON (OFF if APU is used).
2. UHF radio - ON.

Note

Low input voltage during engine starts may result in momentary loss of UHF radio reception.

3. Warning lights switch - AS DESIRED.
4. Caution indicator and warning lights - CHECK (PRESS test switch).
5. Gear warning - CHECK.

▲ AIRCRAFT 67-14776 THRU 68-7943 EXCEPT MODIFIED PER T.O. 1A-37B-503.

▲ AIRCRAFT 68-7974 AND ON AND AIRCRAFT 67-14776 THRU 68-7973 WHEN MODIFIED PER T.O. 1A-37B-504.

6. Interior lights - AS DESIRED.
7. Exterior lights - AS REQUIRED.
8. Inverter switch - SPARE.
9. Fuel quantity -
   a. TEST and CHECK FUSELAGE ⚠1.
   b. TEST and CHECK ⚠2.

PRIOR TO STARTING ENGINES.

1. All loose items - STOWED.

STARTING ENGINES

Note

- To prevent damage to starter-generator, do not use external power units which exceed 1200 ampere output.
- If the fuel boost pump warning light is not out, do not start engines.

1. Left engine start:
   a. Engine start button - PUSH and RELEASE.
   b. Left ignition indicator light - CHECK ON.
   c. Throttle - IDLE at 6 to 8% RPM.
   d. Engine instruments - CHECK.

CAUTION

If EGT exceeds 900° during start, abort the start to preclude exceeding transient limits. If EGT exceeds 1000°, record EGT and duration of high EGT.

   e. Engine start buton - PUSH AND RELEASE at 40% to disengage starter and ignition.

CAUTION

After engine start, the generator should cut in when the APU is disconnected. Check the loadmeter for a rise in indication. If the loadmeter shows no rise, increase RPM to 65%. If the loadmeter still shows no indication, shutdown the engine.

   f. APU - DISCONNECT (if applicable).
   g. Battery switch - ON (if applicable).
   h. Loadmeter - CHECK.
2. Hydraulic pressure - CHECK for 1250 to 1550 psi.
3. Engine inlet screens - CHECK UP.
4. Left engine RPM - ADVANCE TO 60%.

Note

When starting on asphalt surface, left engine RPM should be left in idle to avoid heat damage to the ramp area.

5. Right engine start - SAME PROCEDURE as above.
6. Fuel system switch - NORMAL.
7. Inverter switch - MAIN.
8. Voltmeter - CHECK.

BEFORE TAXIING

1. MM-3 attitude indicator - CHECK for proper operation and adjust the horizon bar to coincide with miniature aircraft.
2. Stand-by attitude indicator - UNCAGE and adjust.

Note

Manually return caging knob to the uncaged position. Do not allow knob to snap forward against the instrument.

3. IFF - STAND-BY.
4. Radios and Navigation aids - ON.
5. Trim operation - CHECK.
6. Aileron, elevator and rudder trim - NEUTRAL.
7. Flaps - CHECK and SET.
8. Radios - CHECK.
9. Altimeter - SET and CHECK.

WARNING

Special attention should be given to the altimeter, when setting the barometric scale, to assure that the 10, 000 foot pointer is reading correctly. The low altitude symbol should be visible below 16, 000 feet.

10. Safety pins - REMOVE.
    a. Ejection seat safety pins - REMOVE and visually display.
    b. Canopy jettison T-handle safety pin - REMOVE and visually display.

WARNING

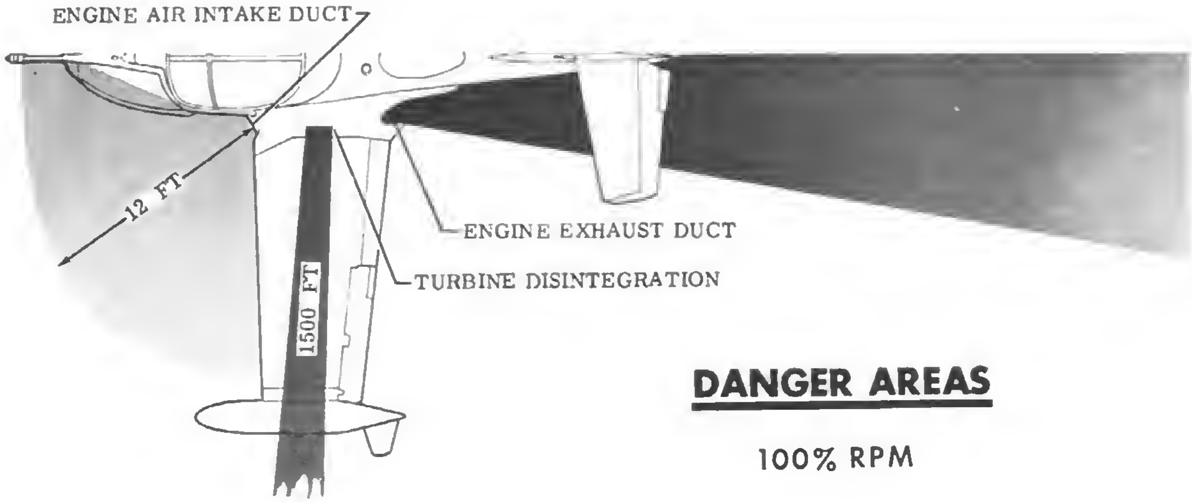
- When removing ejection seat arming handles safety pin, place left-hand on the left arming handle to insure that the arming handles are held down while the pin is removed and streamer is cleared from the seat.
- During all ground operation, if seat adjustments become necessary, install arming handles safety pin before moving the seat adjustment lever.
- In flight, exercise extreme care to insure that feet are clear of the arming handles and that the proper handle is moved to raise and lower the seat.

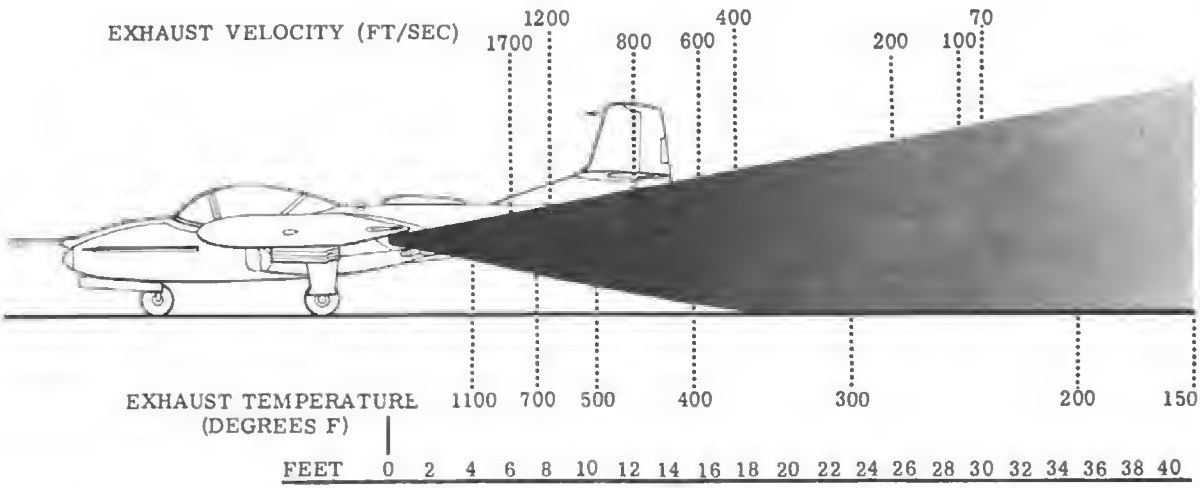
11. Canopy - CHECK.
12. Chocks - REMOVE.

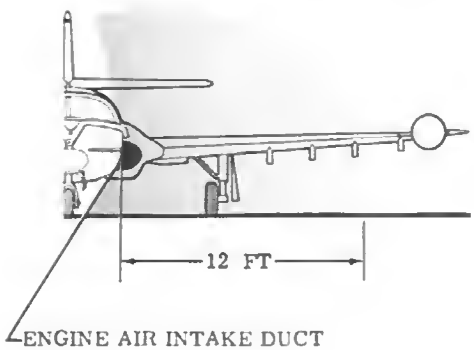
⚠1 AIRCRAFT 67-14776 THRU 68-7943 EXCEPT MODIFIED PER T.O. 1A-37B-503.
⚠2 AIRCRAFT 68-7944 AND ON AND AIRCRAFT 67-14776 THRU 68-7943 WHEN MODIFIED PER T.O. 1A-37B-503.

DANGER AREAS

100% RPM







WARNING

- Suction at the engine intake duct is sufficient to kill or severely injure personnel drawn into, or against the duct.
- Use minimum power for taxi.

Figure 2-2

TAXIING

1. Brakes - RELEASED and CHECKED.
2. Nose wheel steering - CHECKED.

CAUTION

- Continuous depression of the nose wheel steering control switch button is not recommended as this may cause failure of the nose wheel steering system.
- Insure that the speed brake and thrust attenuators are retracted when the aircraft is stopped.
- Use minimum power for taxi.
- Do not ride brakes to control taxi speed. Control taxi speed with thrust attenuators.
- To prevent inadvertent jettisoning or damage to the canopy, do not unlock or open canopy above 40 KIAS.

CAUTION

At taxi speeds between 10 to 20 KIAS the wings may oscillate up and down. This is caused by the main gear tires being slightly out of round from standing for long periods of time at heavy weight or from taxiing on an uneven surface. The taxi speed should be increased or decreased to stop these oscillations.

Note

To prevent heat damage to asphalt ramps, taxiways and runways, the use of more than idle RPM while the aircraft is stopped should be avoided.

3. Flight instruments - CHECK.
   a. Altimeter - CHECK.
   b. Airspeed indicator - CHECK READING.
   c. Heading indicators - CHECK HEADING against stand-by magnetic compass, verify that stand-by magnetic compass bowl is full of fluid.

MINIMUM TURNING RADIUS AND GROUND CLEARANCE

Minimum Ground Clearance

AERIAL REFUELING BOOM (If Installed)	2 FT. 9 IN.
WING TIP	3 FT. 4 IN.
TIP TANK	3 FT.
MAIN GEAR INBOARD DOORS	6 IN.
MAIN GEAR OUTBOARD DOORS	10 IN.
VENTRAL FIN	2 FT. 10 IN.

Note

TURNING RADII DETERMINED WITH USE OF NOSE WHEEL STEERING AND BRAKES.

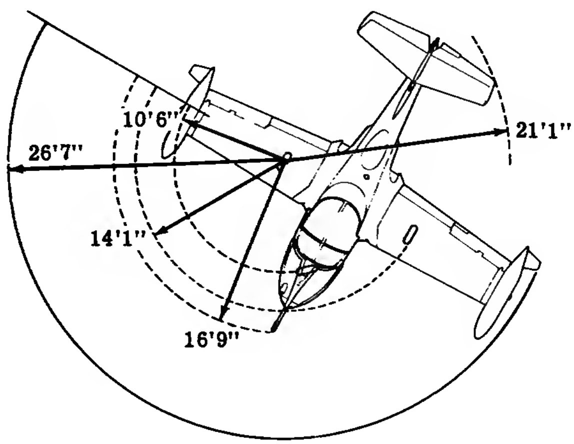


Figure 2-3

d. MM-3 attitude indicator and stand-by attitude indicator - CHECK for attitude warning flag not showing, proper operation, and adjust the horizon bar to coincide with the miniature aircraft.
e. Turn and slip indicator - CHECK. During turns, check that turn needle indicates the proper direction and ball is free in the glass tube.

BEFORE TAKEOFF

1. Zero-delay lanyard hook - CONNECTED.
2. Flight controls - CHECK for freedom of movement and proper operation of slot lip spoilers.
3. Takeoff trim - CHECK elevator takeoff trim and rudder neutral lights illuminated. Visually check aileron trim neutral.
4. Pitot heat switch - AS REQUIRED.
5. Exterior lights switches - AS REQUIRED.
6. Flaps - AS REQUIRED.
7. Tip tank switches - ON or fuel selector switch - AUX PYLON TANK.

Note

The air refueling panel may be used to determine if the selected tanks begin feeding.

8. IFF - AS REQUIRED.
9. Caution indicator and warning lights - CHECK.
10. Loadmeters - CHECK.
11. Voltmeter - CHECK.
12. Anti-collision beacon switch - AS REQUIRED.
13. Speed brake switch - IN.
14. Canopy - CLOSED and LOCKED. Check light out. Before closing canopy, check that canopy sill is free of obstructions and notify other crew member. Wait for confirmation that he is clear, then hold canopy switch in the CLOSE position until the canopy is fully closed. After the canopy is closed, move the locking handle forward and check that the "canopy-not-locked" red warning light goes out.
15. Nose gun safing pin - CHECK removed ▲.

PREFLIGHT ENGINE CHECK

1. Throttles - 85% RPM.

Note

If takeoff roll is initiated on an asphalt surface, the power check portion of this check should be accomplished during the first part of the ground roll.

2. Engine instruments - CHECK for proper indication.
   a. Tachometers.
   b. Exhaust gas temperature indicators.
   c. Fuel flow indicators.
   d. Oil pressure indicators.
   e. Master caution light - OUT.
   f. Hydraulic pressure gage.
   g. Loadmeters.

Note

- Nickel cadmium batteries may be charged at a much greater rate without damage than can the conventional lead-acid batteries. Engine starts using battery power will normally be followed by extremely high loadmeter readings. High loadmeter readings may persist for as long as 10 minutes after takeoff. Loadmeter reading will gradually decrease as the battery becomes charged unless some electrical malfunction is present.

- The loadmeters should be checked immediately after takeoff and every 15 minutes thereafter. After 10 minutes of flight, loadmeter reading should be 0. 5 or below. Maximum loadmeter for takeoff is 0. 8.

   h. Voltmeter.
3. Anti-icing system operation - CHECK (if required), for EGT rise of 10 - 20 degrees.
4. Heat and vent system - AS REQUIRED.
5. Engine inlet screens - AS REQUIRED.
6. Throttles - 100% at brake release.

TAKEOFF

WARNING

Avoid wake turbulence. Allow a minimum of two minutes before takeoff behind a heavy aircraft or helicopter. The time should be extended to a minimum of four minutes behind extremely heavy aircraft, i. e., C-5A or 747. With effective crosswinds of over 5 knots, the interval may be reduced, but attempt to remain above and upwind of the preceding aircraft's flight path.

Refer to Appendix I for takeoff charts showing distances required at varying gross weights, temperatures, field elevations, wind and runway conditions. After completion of the Preflight Engine Checks, release brakes and establish a straight takeoff roll. Directional control should be maintained by use of nose wheel steering until rudder becomes effective at approximately 60 KIAS. Care should be used to prevent overcontrolling when using nose wheel steering. At approximately 10 KIAS below computed takeoff speed, raise the nose smoothly to takeoff attitude. Maintain this attitude and allow the aircraft to fly off the ground.

▲ AIRCRAFT 70-1280 AND ON AND AIRCRAFT 67-14776 THRU 70-1279 WHEN MODIFIED PER T. O. 1A-37-523.

CROSSWIND TAKEOFF

Release brakes and maintain directional control by use of the nose wheel steering, ailerons and rudder. At the computed nose wheel lift-off speed (refer to crosswind chart in the appendix), raise the nose to the normal takeoff attitude. Continue to use rudder and ailerons for maintaining directional control. After becoming airborne, correct for drift by turning into the wind. Observing the minimum nose wheel lift-off speed will insure sufficient rudder control to maintain runway heading prior to becoming airborne.

AFTER TAKEOFF

1. Gear lever - UP (110 KIAS minimum).

CAUTION

Do not raise the landing gear until definitely airborne.

Note

- On aircraft ▲1, the gear down limit speed is 150 KIAS. On aircraft ▲2, the gear down limit speed is 170 KIAS.
- The landing light limit is 156 KIAS.
- The flap down limit speed is 170 KIAS.

2. Flap handle - UP.
3. IFF - CHECK.

CLIMB CHECK

1. Oxygen diluter lever - NORMAL.
2. Fuel - CHECK.

CAUTION

Fuel transfer indications should be checked as soon as possible after takeoff to detect fuel transfer malfunctions.

3. Yaw damper switch - ON.
4. Engine inlet screens - AUTO.
5. Zero-delay lanyard - DISCONNECT when passing through 10,000 feet pressure altitude when this altitude will be exceeded for prolonged periods.

Note

If operating above terrain over 8000 feet high, the zero-delay lanyard should remain connected until the aircraft is at least 2000 feet AGL.

6. Altimeter - 29.92 (FL 180 or above).

LEVEL OFF SAFETY CHECK

1. Oxygen system - CHECK.

WARNING

Leaving the oxygen diluter lever in the 100% OXYGEN position will greatly shorten the duration of the oxygen system. See figure 1-44 for oxygen duration.

2. Engine instruments - CHECK.
3. Electrical indicators - CHECK.
4. Fuel - CHECK.

CRUISE

Refer to Appendix I for cruise data.

FUEL SYSTEM MANAGEMENT

Internal Fuel (Normal)

Operation of the internal fuel system is essentially automatic requiring no action from the pilot during flight. The fuel system switch should be in the NORMAL position for all normal operations. Fuel will be transferred by the proportioner pumps, from the wing tanks to the fuselage tank in equal quantity. The float switch in the fuselage tank controls and actuates the proportioner pumps and annunciator panel lights in normal operation.

External Fuel (Normal)

Tip tank fuel when selected is pumped into the wing fuel cells. When pressure buildup is sufficient to cause the annunciator panel light to go out, tip fuel is then being transferred. When the pressure drops the light will illuminate and tips will be empty. Tip fuel is controlled by the panel switches, not the float switch. Tip fuel will take approximately 25 to 30 minutes to transfer to the wing cells. Pylon tanks and tip fuel should not be selected at the same time because no fuel is drawn from the wing when the pylon tanks are selected. Tip fuel will then recirculate through the vent from the wing cell tank to the tip tanks.

Pylon tank fuel when selected, is drawn by the proportioner pumps to the fuselage tank. The Pylon Tanks Empty light will illuminate when the float switch is low enough to actuate the light, indicating that the pylon fuel has been transferred and the fuselage level has decreased to that float position, approximately 360 to 380 pounds.

▲1 AIRCRAFT 67-14776 THRU 70-1310 EXCEPT WHEN MODIFIED PER T. O. 1A-37B-555.
▲2 AIRCRAFT 70-1311 AND ON AND AIRCRAFT 67-14776 THRU 70-1310 WHEN MODIFIED PER T. O. 1A-37B-555.

CAUTION

Extended operation at high fuel flow rates may result in illumination of the low level warning light. Temporary reduction of the fuel flow rate will correct the situation, since fuel flow can exceed proportioner output.

Note

It is possible, through fuel mismanagement, to get in the position of having wing tanks empty and the fuselage fuel level below the gravity feed point, but still have fuel in the pylon tanks. It is impossible to utilize this pylon fuel because the proportioner pumps are deactivated during a gravity feed situation. However, this condition may be remedied by placing the fuel system switch to NORMAL, the fuel selector switch to AUX PYLON TANK and pulling the FUEL MGMT circuit breaker. The proportioner pumps will then drain out the pylon fuel. When the fuselage tank becomes sufficiently replenished to extinguish the FUEL GRAVITY, FUEL LOW and PYLON TANK EMPTY lights, the circuit breaker can be reset and the system will function normally.

Note

In the event of fuel system malfunction check the fuel quantity to determine usable fuel aboard.

When a complete electrical failure occurs the fuel system will automatically convert to gravity fuel, but there will be no indication of this on the annunciator panel.

WARNING

The red low level warning light on the annunciator panel will be inoperative, also pylon and tip fuel will be inaccessible with a complete electrical failure. Wing and fuselage fuel become the only usable fuel available.

FUEL SYSTEM MALFUNCTIONS

Fuel Unbalance

Unbalance in the wing fuel cells may result due to improper refueling on the ground when the lateral attitude of the aircraft is sloping (due to ramp, unequal shock struts, etc.). Wing fuel quantities should be checked for balance on preflight. Fuel unbalance because of improper fueling may not be noticed until approximately 10 minutes after takeoff. If unbalance is noted during preflight, partial unbalance may be corrected, if taxi distance is long enough by going to GRAVITY fuel during taxiing. Check in NORMAL prior to takeoff. A slight unbalance can exist with no malfunction of the fuel system. On aircraft ▲1, if at anytime an unbalance is suspected or aileron trim in one direction is excessive to maintain level flight, the fuel system switch should be placed in the GRAVITY position. Slipping the aircraft toward the light fuel tank will help move fuel to the fuselage fuel tank. On aircraft ▲2, when the needles of the left and right wing fuel quantity indicator differentiate 200 pounds maximum, a significant fuel unbalance exists and the fuel system switch should be placed in the GRAVITY position. Slipping the aircraft toward the light fuel tank will help move fuel to the fuselage fuel tank.

WARNING

> If the fuel imbalance cannot be corrected refer to Section VI for landing with asymmetrical loads.

A landing should be made as soon as possible if fuel unbalance becomes more pronounced. The increasing unbalance indicates a malfunction and the aircraft should be landed.

Tip tanks not feeding may be a cause of unbalance and will be more pronounced by requiring excessive aileron trim and stick force away from the heavy tank. Tip fuel can be dumped to help this condition. The best dump speed is 135 KIAS. At this speed fuel is dumped at the rate of 40 gallons per minute and takes approximately 2 minutes and 20 seconds to empty a full tank. The dump speed may be increased for better aircraft control; however, the rate of dump diminishes with increased airspeed. In level flight at approximately 300 KIAS the aircraft attitude is such that little if any fuel will be dumped from the tips. Tip tanks will not dump in a descent or when decelerating.

▲1 AIRCRAFT 67-14776 THRU 68-7943 EXCEPT MODIFIED PER T. O. 1A-37B-503.
▲2 AIRCRAFT 68-7944 AND ON AND AIRCRAFT 67-14776 THRU 68-7943 WHEN MODIFIED PER T. O. 1A-37B-503.

WARNING

> If wake turbulence is entered with an asymmetrical load of fuel or stores during a roll, or descent, or combination of the two, the aircraft could continue in that direction even though full control travel or power is applied.

Fuselage Fuel Float Switch (see figure 1-9)

If the fuel level decreases, for any reason, to the 295 ±20 pound level in the fuselage tank, the switch will actuate the amber low level warning light on the annunciator panel, shutoff the proportioner pumps, and open the fuel shutoff valves. This allows fuel to by-pass the proportioner pumps and enter the fuselage tank by gravity flow. The green gravity fuel light on the annunciator panel will come on when the solenoid-locked fuel shutoff valves open. As gravity feed raises the fuel level in the fuselage tank, the amber low level warning light will go out. If there has not been an electrical failure in the proportioner pump circuit the solenoid-locked fuel shutoff valves will close and the proportioner pumps will be turned on. The green gravity feed light will go out. If there has been an electrical failure in the proportioner pumps they will not come on again and the system will remain in gravity feed. Pylon fuel cannot be used without the proportioner pumps operational.

CAUTION

> Extended operation at high fuel flow rates may result in illumination of the low level warning light. Temporary reduction of the fuel flow rate will correct the situation, since fuel flow can exceed proportioner output.

Note

- It is possible, through fuel mismanagement, to get in the position of having wing tanks empty and the fuselage fuel level below the gravity feed point, but still have fuel in the pylon tanks. It is impossible to utilize this pylon fuel because the proportioner pumps are deactivated during a gravity feed situation. However, this condition may be remedied by placing the fuel system switch to NORMAL, the fuel selector switch to AUX PYLON TANK and pulling the FUEL MGMT circuit breaker. The proportioner pumps will then drain out the pylon fuel. When the fuselage tank becomes sufficiently replenished to extinguish the FUEL GRAVITY, FUEL LOW and PYLON TANK EMPTY lights, the circuit breaker can be reset and the system will function normally.
- In the event of fuel system malfunction check the fuel quantity to determine usable fuel aboard.

When a complete electrical failure occurs the fuel system will automatically convert to gravity fuel, but there will be no indication of this on the annunciator panel.

WARNING

The red low level warning light on the annunciator panel will be inoperative, also pylon and tip fuel will be inacessible with a complete electrical failure. Wing and fuselage fuel become the only usable fuel available.

When the high level float switch fails the proportioner pumps will not shutoff and excess fuel will be pumped overboard through the fuselage tank vent valve to prevent fuselage fuel tank rupture.

Note

If an excessive drop in fuel quantity is indicated on the fuel quantity indicator (40 to 50%) it is possible the high level float switch is malfunctioning and fuel is being pumped overboard through the fuselage tank vent. The fuel system switch should be positioned to GRAVITY and the fuel quantity indicator monitored for a normal drop the remainder of the flight.

Whenever fuel system malfunction is suspected, switch immediately to GRAVITY fuel and land as soon as practicable.

Single Engine Cruise

Refer to Appendix I for single engine cruise data.

1. Throttle - CUT-OFF (for desired engine shutdown).
2. Generator switch - OFF.
3. Retrim - AS DESIRED.

When operating for extended periods on single engine, the operating engine should be alternated every 30 minutes to provide adequate lubrication and prevent excessive oil loss from the windmilling engine.

For single engine cruise, fuel management is the same as normal cruise; however, when using tip fuel allow the fuel level to decrease. This prevents the tip pump from recirculating wing and tip fuel, and lengthens pump life.

Leave the T-handle in the PUSH-ON position to allow for fuel control, fuel cooling in the shutdown windmilling engine.

AIRSTART

The following procedures are to be accomplished when airstarting a dead engine.

1. Throttle - CUT-OFF.

CAUTION

Prior to attempting an airstart observe the following; tachometer for engine windmilling at least 6% rpm, below 6% use extreme caution because of higher temperatures involved. 140 KIAS is minimum for airflow; 180 KIAS is the best speed for a start. If engine has seized do not attempt to restart. EGT will be high at low rpm, high altitude and with screens up. This can be compensated by a higher airspeed.

2. Fuel shutoff T-handle - PUSH-ON.
3. Generator switch - ON.
4. Engine start button - PRESS.
5. Ignition indicator light - ON.
6. Throttle - IDLE.
7. Exhaust gas temperature - MONITOR. The first indication of a start is a rise in EGT.

CAUTION

If the EGT exceeds 900°C, move the throttle to CUT-OFF and attempt another start if warranted.

8. Engine instruments - CHECK.

FLIGHT CHARACTERISTICS

Refer to Section VI for information regarding flight characteristics of the aircraft.

DESCENT

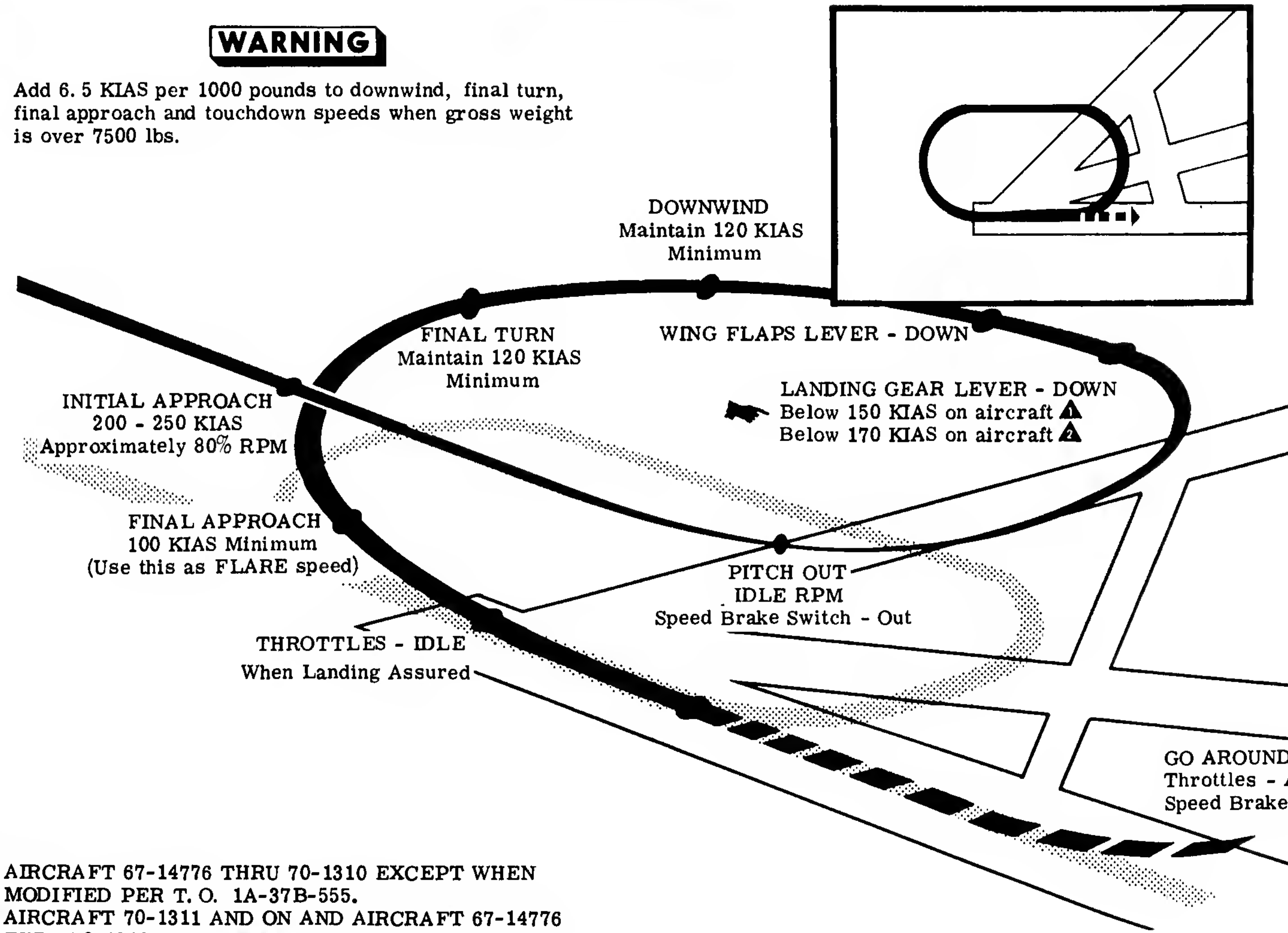
Refer to Appendix I for data concerning descents from various altitudes. Power settings, speed brake and thrust attenuator position depend on the performance desired. Any speed brake and power settings may be used during the descent, providing the airspeed limitations in Section V are not exceeded.

1. Altimeter - SET.
2. Heading indicator - CROSSCHECK with magnetic compass.
3. Defrost knob - AS REQUIRED. Rapid descents may cause fogging inside the canopy. Therefore, it is necessary that the canopy and windshield be kept as warm as possible to maintain proper visibility.
4. Pitot heat switch - AS REQUIRED.
5. 10, 000 feet check:
   a. Oxygen diluter lever - AS REQUIRED.
   b. Fuel - CHECK.
   c. Yaw damper - AS DESIRED.
   d. Armament panel switches - OFF.
   e. Zero-delay lanyard - CONNECT, prior to initial penetration fix or at 10, 000 feet MSL or 2000 feet AGL.

TYPICAL OVERHEAD LANDING PATTERN

WARNING

Add 6.5 KIAS per 1000 pounds to downwind, final turn, final approach and touchdown speeds when gross weight is over 7500 lbs.



1 AIRCRAFT 67-14776 THRU 70-1310 EXCEPT WHEN MODIFIED PER T.O. 1A-37B-555.

2 AIRCRAFT 70-1311 AND ON AND AIRCRAFT 67-14776 THRU 70-1310 WHEN MODIFIED PER T.O. 1A-37B-555.

Figure 2-4

BEFORE LANDING

APPROACH TO FIELD

During the approach to the field and before entering the traffic pattern, perform the following checks:

1. Hydraulic pressure - CHECK.
2. Engine inlet screen switch - AUTO.
3. Speed brake switch - AS REQUIRED.

INITIAL APPROACH

1. Airspeed - 200 to 250 KIAS.

180° TURN TO DOWNWIND LEG

1. As bank is established for the 180° turn to downwind, reduce throttles to IDLE RPM.
2. Speed brake switch - OUT.

DOWNWIND LEG

Maintain altitude on downwind leg while reducing airspeed and perform the following:

1. Gear lever - DOWN below 150 KIAS on aircraft ▲1 or 170 KIAS on aircraft ▲2.
2. Gear position indicators - CHECK.
   a. Gear position indicator lights.
   b. Gear warning lights.
   c. Audio tone signal.

Maintain altitude and 120 KIAS minimum until starting final turn.

3. Flap lever - DOWN.

WARNING

Add 6.5 KIAS per 1000 pounds, to downwind, final turn, final approach and touchdown speeds when gross weight is over 7500 pounds.

FINAL TURN

1. Airspeed - 120 KIAS (minimum).

FINAL APPROACH

1. Airspeed - 100 KIAS (minimum).
2. Landing lights - AS REQUIRED.
3. Throttles - IDLE (when landing is assured).

▲1 AIRCRAFT 67-14776 THRU 70-1310 EXCEPT WHEN MODIFIED PER T. O. 1A-37B-555.
▲2 AIRCRAFT 70-1311 AND ON AND AIRCRAFT 67-14776 THRU 70-1310 WHEN MODIFIED PER T. O. 1A-37B-555.

WARNING

Due to the lack of a positive locking device on the Landing Gear Control Handle, it is possible for the gear handle to creep up enough to permit gear retraction after the landing gear has been lowered. To preclude inadvertent landing gear retraction on final or after touchdown, the pilot should visually recheck the Landing Gear Control Handle in the full down position on final approach.

CAUTION

When making high gross weight power-on approaches at or near stall speeds, abrupt power reductions or rapid change in angle of attack may result in an inadvertant stall and/or high sink rate.

LANDING

WARNING

Avoid wake turbulence. Allow a minimum of two minutes before landing behind a heavy aircraft or helicopter. The time should be extended to a minimum of four minutes behind extremely heavy aircraft, i. e., C-5A or 747. With effective crosswinds of over 5 knots, the interval may be reduced, but attempt to remain above and upwind of the preceding aircraft's flight path.

NORMAL LANDING

1. Flap handle - UP after touchdown, prior to braking.
2. Nose wheel steering - ENGAGE.

Note

To avoid excessive swerve, neutralize the rudder prior to engaging nose wheel steering.

See figure 2-4 for typical overhead landing pattern and recommended procedure. Refer to Appendix I for recommended approach and touchdown speeds for varying gross weights, wind conditions, and configurations.

On final approach use wing-low technique for crosswinds in order to maintain runway alignment. If strong crosswinds are encountered, increase final approach speed 5 to 10 knots. Just before reaching the end of the runway, start the roundout by smoothly establishing a nose-high attitude. Continue to maintain the wing-low attitude for crosswind. This will require increased control deflections as airspeed decreases during the roundout. Plan touchdown at recommended main gear touchdown speed. (See Appendix I.) Touchdown on the main wheels in a nose-high attitude.

The aircraft weathervanes when landing in strong crosswinds. Lower the nose to the runway as soon as possible after touchdown, raise the flaps, and use

nose wheel steering, rudder, and brakes if necessary to maintain directional control. Continue to maintain ailerons deflected into the wind during the landing roll.

If a high gust wind condition is encountered, half flaps should be used in the pattern, and final approach speed should be increased 1/2 the gust velocity.

NO FLAP LANDING

The procedure for landing without flaps is the same as for normal landing. Plan a longer final approach, increase base and final approach airspeed by 10 knots, and expect an extended flare and longer landing roll. The +6.5 KIAS per 1000 pounds is also applicable.

MINIMUM-RUN LANDING

To perform a minimum-run landing establish a flat power-on final approach, decreasing to a final approach airspeed of 95 KIAS (plus 6.5 KIAS per 1,000 pounds when gross weight is over 7500 pounds). With gear and flaps full down, additional drag can be obtained through the use of the speed brake and the screens. If the outside air temperature is below freezing and visible moisture is present, do not extend inlet screens due to the possibility of the screens freezing up. Fly the aircraft with power until reaching the touchdown point, then retard the throttles to idle.

CAUTION

Avoid abrupt power reduction at or near stall speeds on minimum-run landings. The stall speeds increase by approximately 8 KIAS for any loading as the power of both engines is decreased from 100% to idle power.

After touchdown, lower the nose wheel to the runway and raise the flaps. Use a single smooth application of brakes with constantly increasing pedal pressure while pulling back on the stick just short of raising the nose wheel.

Note

The technique required for minimum-run landing should be developed through familiarity and practice of each phase before attempting to achieve the maximum results.

Consult the BRAKING PROCEDURES paragraph in this section for a further discussion of achieving maximum braking effectiveness.

BRAKING PROCEDURES

Wheel brake effectiveness increases as forward speed decreases. On landing, use wheel brakes only as required to decelerate the aircraft to normal taxi speed on the remaining runway. If maximum braking is required after touchdown, lower the nose wheel to the runway and raise the flaps. This will decrease lift and put more weight on the main wheels for increased friction. Use a single smooth application of brakes with constantly increasing pedal pressure. Optimum braking is achieved when maximum aircraft weight is on the main wheels and a very slight skid is maintained (approximately 15-20% rolling skid). Braking action decreases if a wheel is locked and the tire is in an excessive skid. If a skid results, brake pressure must be released and then reapplied to achieve normal braking action. Braking effectiveness can be increased by pulling back on the stick just short of raising the nose wheel.

WARNING

If maximum braking is used, aircraft should not be taxied into a congested area. Peak temperatures occur in the wheel and brake assembly ten to fifteen minutes after maximum braking operation. This could result in brake failure or possible fire or explosion. Insure all personnel remain clear of the main wheels until they have cooled.

Note

Brakes, themselves, can merely stop the wheels from turning, but stopping the aircraft is dependent on the friction of the tires on the runway.

USE OF WHEEL BRAKES

WARNING

On aircraft not modified by TCTO 1A-37B-549, "Deactivation of Parking Brake Valve," pilots are cautioned to not apply wheel brakes in flight since the parking brake valve can malfunction resulting in a locked wheels condition during landing.

To reduce maintenance difficulties and accidents due to wheel brake failure, brakes should be treated with respect. The most common mistakes that reduce brake life and reliability are stopping the aircraft as quickly as possible, use of brakes consistently for taxiing turns, and dragging brakes while taxiing. When applying brakes, there may be a slight time delay between the pedal release and the release of braking action. To minimize brake wear, the following precautions should be observed insofar as is practicable.

1. Use extreme care when applying brakes immediately after touchdown or at anytime when there is considerable lift on the wings to prevent skidding the tires and causing flat spots. A heavy braking pressure can result in locking the wheels, if brakes are applied immediately after touchdown than if the same pressure is applied after the full weight of the aircraft is on the wheels. A wheel locked will not unlock as the load is increased as long as brake pressure is maintained.

2. If maximum braking is required after touchdown, lift should first be decreased by raising the flaps and dropping the nose before applying brakes.
3. For short landing rolls, a single smooth application of the brake with constantly increasing pedal pressure is most desirable.
4. If brakes have been used on landing roll it is recommended that a minimum of six minutes elapse between landings where the landing gear remains extended in the airstream, and a minimum of 10 minutes between landings where the landing gear has been retracted to allow sufficient time for cooling between brake applications.
5. The full landing roll should be utilized to take advantage of aerodynamic braking and to use the brakes as little as possible.
6. After the brakes have been used excessively for an emergency stop and are in the heated condition, the aircraft should not be taxied into a congested parking area or the parking brakes set.

STRAIGHT-IN APPROACH

When a straight-in approach is required, proceed as follows: Enter from outside the normal traffic pattern at traffic pattern altitude and at the airspeed required for the situation (i. e., 200 KIAS for normal conditions, 130 KIAS minimum for a nose access door malfunction, etc.). At least 3 miles from the end of the runway, reduce speed to below 150 KIAS, if necessary, by reducing throttles to IDLE rpm and lowering speed brake, and lower the landing gear. As the normal glide path is approached, lower flaps if required, adjust throttles, and continue as in a normal final approach.

LANDING ON SLIPPERY RUNWAYS

Touchdowns should be planned close to the approach end of the runway in order to utilize all the available runway length. Use recommended pattern and touch down speeds since excessive landing speeds will result in longer stopping distance. Use aerodynamic braking as much as possible and ensure that the thrust attenuators are extended. Use brakes lightly, applying pedal pressure evenly and slowly. If brakes are applied hard and suddenly a skid will result. Use nose wheel steering primarily for directional control. Differential braking may be used to aid in directional control unless it results in skidding. If skidding occurs, reduce or release brake pedal pressure and use nose wheel steering for directional control. Landing roll distances will be considerably increased over the minimum for a dry runway, but since maximum braking is seldom required in normal operation, the distances will not normally appear excessive.

WAKE TURBULENCE

Avoid wake turbulence. If possible, allow a minimum of two minutes before takeoff or landing behind a heavy aircraft or helicopter. The time should be extended to a minimum of four minutes behind extremly heavy aircraft, i. e., C-5A or 747. With effective crosswinds of over 5 knots, the interval may be reduced, but attempt to remain above and upwind of the preceding aircraft's flight path. This will permit the lateral displacement of the phenomenon of wing tip vortices. This phenomenon is the result of a lifting wing shedding a continuous sheet of vortices or eddies along its trailing edges. The vortices, being unstable, roll up quickly into a pair of vortex cores, behind each wing near the tip. The vortices descend vertically down toward the runway, and near the ground move laterally. The rate of descent and lateral movement is approximately 300 to 350 feet per minute. Wake turbulence will be most pronounced during conditions of calm or near calm surface wind. An aircraft penetrating the center of a vortex core would be subjected to a vertical airflow having a downward direction on one wing and an upward direction on the other. The aircraft will roll very rapidly, exceeding the amount of control available to counteract the rolling action.

PORPOISING

CAUTION

> Avoid landing on the nose wheel first or porpoising will result.

Porpoising is a condition encountered during landing wherein the aircraft bounces back and forth between the nose wheel and the main gear after initial ground contact. This porpoising condition is caused by an incorrect landing attitude upon touchdown, which brings the nose wheel in contact with the runway before the main gear touches down. This condition most likely will occur when landing is attempted with an incorrect landing attitude and at an excessive airspeed. If immediate corrective action is not initiated, the porpoise will progress to a violent, unstable oscillation of the aircraft about the lateral axis. These repeated heavy impacts of the aircraft on the runway will ultimetely result in structural damage to the landing gear and airframe. Therefore, a proper landing attitude immediately prior to touchdown is imperative to preclude the occurrence of the porpoise. If porpoising should be encountered, immediately reposition the controls (stick NEUTRAL or slightly aft) to establish the normal landing attitude. Maintain this attitude and simultaneously advance throttles to 100% rpm. Do not attempt to counteract each bounce with opposite stick movement, because the combined reaction time of pilot and aircraft is such that the cited control movement will aggravate the porpoising action. Repositioning and holding the controls (restricting movement) will dampen out the oscillation. The addition of power will increase control effectiveness by increasing airspeed and permit the aircraft to become safely airborne once again and eliminate further porpoising.

CAUTION

> After experiencing porpoising on a hard landing and go-around is attempted, do not raise the landing gear. Structural damage can occur and can prevent the landing gear from being lowered on the following landing attempt.

Note

Directional control may be difficult to maintain if uneven engine acceleration occurs when throttles are advanced or when a crosswind exists.

TOUCH AND GO LANDING

1. Normal touchdown.
2. Throttle(s) - AS REQUIRED.
3. Speed brake switch - IN.
4. Gear lever - UP (110 KIAS minimum).

CAUTION

Do not raise the landing gear until definitely airborne.

5. Flap handle - UP.

GO-AROUND

1. Throttle(s) - AS REQUIRED.

WARNING

- Use extreme caution if fuel unbalance or asymmetrical load exists.
- Use caution when advancing throttle(s) to control the resulting yaw.
- Beware of wake turbulence.

Note

- Decide early in the approach if it is necessary to go-around and start go-around before too low an altitude and airspeed is reached.
- On single engine go-around acceleration will be slightly slower.

2. Speed brake switch - IN.
3. Gear lever - UP (110 KIAS minimum).

CAUTION

Do not raise the landing gear until definitely airborne.

4. Flap handle - UP.

AFTER LANDING

1. Flap handle - CHECK UP.
2. Canopy - AS DESIRED. Stow all loose items prior to opening canopy.
3. Engine inlet screens - CHECK UP.
4. Anti-collision beacon switch - OFF.
5. IFF and Nav aids - OFF.
6. Pitot heat switch - OFF.
7. Trim - NEUTRAL.
8. Fuel system switch - GRAVITY.

Note

It is permissible to shut one engine down to reduce taxi speed thereby reducing braking action and increasing brake life. If this procedure is elected, shutdown the left engine so that the right hydraulic pump can be checked.

ENGINE SHUTDOWN

1. Speed brake switch - IN.
2. Left throttle - CUT-OFF.
3. Hydraulic pressure - With the left engine windmilling below 5% RPM, note hydraulic pressure, 1250 to 1550 PSI to check right hydraulic pump.
4. Right throttle - CUT-OFF.
5. Inverter switch - OFF.
6. All electrical switches - (except generators) - OFF.

BEFORE LEAVING AIRCRAFT

1. All switches - CHECK.
2. Ram air lever - CLOSED.
3. Safety pins - INSTALLED.
4. Chocks - IN PLACE.

Note

- Be sure chocks are in place before releasing brakes.
- Do not set the parking brake after heavy braking. Heat generated may lock the brakes.

5. Flight controls - LOCK (IF REQUIRED).

Note

During cross-country flights, pilots are urged to maintain surveillance during oil tank servicing. Overfilling the oil tank will cause oil to be dumped overboard and cover the tail section of the aircraft. The oil level should be checked immediately after engine shutdown. After engine remains idle for a period of time, oil will drain into the engine lines, bearings, etc., and give a false low reading in the tank.

CHECKLIST

The normal abbreviated checklist is contained in T. O. 1A-37B-1CL-1.

TAKEOFF AND LANDING DATA CARD

The takeoff and landing data card is included in the Flight Crew Checklist. The takeoff and landing information for the planned mission should be entered on the data card and used as a ready reference for review prior to takeoff and landing. A complete sample problem of a mission, to familiarize the pilot with the use of the charts and procedures to fill out the takeoff and landing data card, is shown at the end of Appendix I, Part IX, Mission Planning.

SECTION III

EMERGENCY PROCEDURES

TABLE OF CONTENTS

INTRODUCTION

This section includes procedures to be followed to correct any emergency condition. The procedures, if followed, will insure safety of the pilots and aircraft until a safe landing is made or other appropriate action is accomplished. Multiple emergencies, adverse weather, and other peculiar conditions may require modification of these procedures. Therefore, it is essential that pilots determine the correct course of action by use of common sense and sound judgement. Procedures appearing in bold face capital letters are considered critical action. Procedures appearing in small letters are considered noncritical action. Each is defined as follows:

CRITICAL ACTION

Those actions which must be performed immediately if the emergency is not to be aggravated, and injury or damage are to be avoided. These critical steps will be committed to memory.

NONCRITICAL ACTION

Those actions which contribute to an orderly sequence of events, assure that all corollary preparations are made prior to initiating the critical emergency action.

To assist the pilot when an emergency occurs, three basic rules are established which apply to most emergencies occuring while airborne. They should be remembered by each pilot. The rules follow:

1. Maintain aircraft control.
2. Analyze the situation and take proper action.
3. Land as soon as practicable.

GROUND OPERATIONS

ENGINE FIRE DURING START

If a fire warning light illuminates during an engine start, or if there are visual indications of fire existing in the engine nacelles, proceed as follows:

1. **THROTTLES - CUT-OFF.**
2. **FUEL SHUTOFF T-HANDLES - PULL OFF.**
3. Battery switch - OFF (APU disconnected if used).

TAKEOFF

ABORT

If an abort on takeoff is necessary due to engine failure, fire or other unsafe condition, accomplish the following:

1. **THROTTLE(S) - IDLE (cut-off for fire).**

Note

Cut-off both engines if stopping distance is marginal.

2. **EXTERNAL STORES - JETTISON (if necessary).**
3. Gear lever - DOWN.
4. Speed brake switch - OUT.
5. Brakes - AS REQUIRED.
6. Fuel shutoff T-handle (affected engine) - PULL OFF.

WARNING

- Avoid contacting raised barriers. The barrier webbing can entangle the canopy, possibly causing pilot injury if the canopy is open or jamming the canopy if it is closed. In addition, successful engagement of the barrier is unlikely. The barrier webbing can catch on the nose of the aircraft. This may cause the arresting cable to engage the nose gear, collapsing it. Also, stores may deflect the arresting cable away from the main gear or the cable may become entangled with the stores, creating the hazard of damaged or loose stores. Recommend that, if possible, aircraft continue into the overrun with the barrier down and either continued braking or raising the gear be used to stop the aircraft.
- To afford protection against explosion, heat or fire, the canopy should be retained during aborted takeoff. After the abort, normal canopy opening should be attempted rather than jettisoning the canopy.

Note

In the event of imminent contact with obstruction during landing or takeoff roll or other ground operations, the aircraft is capable of extremely short radius turns even at fairly high speeds with differential braking. Nose wheel steering is not available with both engines inoperative.

LANDING GEAR EMERGENCY RETRACTION

As a last resort, if it is necessary to retract the landing gear while the aircraft is on the ground, proceed as follows:

1. Press landing gear emergency override switch and simultaneously move the landing gear lever to the UP position. (See figure 1-2.)

Note

Use only if stopping distance is critical, then only as a last resort.

If nose gear torque link is broken, normal gear retraction will not occur. Subsequent use of override switch to effect retraction may cause nose wheel to bind in wheel well.

CAUTION

- The landing gear will retract only if hydraulic pressure and electrical power are available.

- Do not use emergency override switch to raise landing gear lever in-flight. Leave the gear down.

ENGINE FAILURE DURING TAKEOFF (TAKEOFF CONTINUED)

If an engine fails immediately after takeoff, the decision to continue depends upon airspeed, altitude and length of runway remaining. If the decision is made to abort, check landing gear down, land the aircraft and follow ABORT procedures. If the decision is made to continue, it is imperative that the gear and flaps be raised as soon as possible. Rate-of-climb with one engine inoperative will be slower, depending on such conditions as air density, gross weight, and configuration. The use of the word maximum as related to throttle movement will vary depending upon airspeed, altitude, remaining runway length and the nature of the circumstances. Maximum settings can vary from 100% to that minimum setting necessary to maintain powered flight. Proceed as follows:

1. THROTTLES - MAXIMUM.
2. EXTERNAL STORES - JETTISON (if necessary).

ENGINE FIRE DURING TAKEOFF (TAKEOFF CONTINUED)

1. THROTTLES - MAXIMUM.
2. EXTERNAL STORES - JETTISON (if necessary).
3. THROTTLE - CUT-OFF (engine indicating fire).
4. FUEL SHUTOFF T-HANDLE - PULL OFF (engine indicating fire).
5. IF FIRE CONTINUES - EJECT.

DOUBLE ENGINE FAILURE DURING TAKEOFF (AFTER AIRBORNE)

If both engines fail immediately after becoming airborne and altitude precludes the possibility of an airstart or ejection, maintain aircraft control and land straight ahead turning only as necessary to avoid obstructions. The following procedures should be used:

If decision is made to stop:

1. ABORT.

If abort is impossible:

2. EXTERNAL STORES - JETTISON.
3. ZOOM, IF POSSIBLE AND EJECT.

WARNING

To afford protection against explosion, heat, or fire, the canopy should be retained during crash landing. After landing, normal canopy opening should be attempted rather than jettisoning the canopy.

IN-FLIGHT

ENGINE FAILURE

Fluctuating rpm, fuel flow and exhaust gas temperature often precede engine failure. When time and altitude permit, airstarts can be successfully accomplished providing fuel supply to the engine is sufficient for normal operation, and no mechanical defects exist which make normal operation hazardous.

WARNING

In the presence of visible moisture and freezing temperatures, inlet screens collect ice very rapidly.

SINGLE ENGINE FAILURE DURING FLIGHT

If an engine fails in-flight, try to determine cause of failure before attempting to restart the engine and continue as follows:

Nonmechanical failure:

1. Throttle - CUT-OFF.
2. Attempt airstart.

If airstart attempt is unsuccessful or deemed inadvisable, proceed with single engine flight and land as soon as practicable using single engine landing procedures.

Mechanical failure or unsuccessful airstart:

1. Throttle - CUT-OFF.
2. Fuel shutoff T-handle (affected engine) - PULL-OFF.
3. Land as soon as practicable.

Refer to Appendix I for single engine performance data.

DOUBLE ENGINE FAILURE DURING FLIGHT (HIGH ALTITUDE)

Note

If fuel boost pump failure is suspected, reduce electrical load and descend below 15, 000 feet MSL if practicable before attempting airstart.

1. Fuel system switch - GRAVITY.
2. Airspeed - 140-180 KIAS.
3. Throttles - IDLE.
4. Either engine start button - PRESS.

CAUTION

Ignition and starting crank is provided for 30 to 45 seconds. Electrical equipment may momentarily become inoperative.

5. If neither engine starts - make forced landing or EJECT.

Refer to forced landing or ejection procedure.

DOUBLE ENGINE FAILURE DURING FLIGHT (LOW ALTITUDE)

1. IGNITION - EMERGENCY.

WARNING

The ignition switch must be moved to the full up position to obtain emergency ignition. Moving the switch to the first position (neutral) cuts off both normal and emergency ignition.

CAUTION

Igniter generators are limited to 45 second operation to prevent them from burning out.

2. FUEL SYSTEM - GRAVITY.
3. THROTTLES - MAXIMUM.
4. AIRSPEED - 140 KIAS minimum.
5. EITHER ENGINE START BUTTON - PRESS.
6. If neither engine starts make forced landing or EJECT.

ENGINE FIRE

A steady red light in the center of either fuel shutoff T-handle indicates fire in the corresponding engine.

Note

It is possible the warning system may malfunction and give an erroneous indication. If there is a fire condition, it is generally supported by other indications. Fire is generally accompanied by one or more of the following indications: Excessive exhaust gas temperature, erratic engine operation, roughness, fluctuating fuel flow, visual indications such as smoke in the cockpit or smoke trailing behind the aircraft. If the aircraft is being flown solo, the mirror on the right side can be used as an aid in detecting smoke from the right engine. Anytime the warning lights illuminate, attempt to verify the condition by other indications before abandoning the aircraft.

ENGINE FIRE DURING FLIGHT

If a fire detect warning light illuminates during flight, proceed as follows:

1. THROTTLE - CUT-OFF (engine indicating fire).
2. FUEL SHUTOFF T-HANDLE - PULL OFF (engine indicating fire).
3. IF FIRE CONTINUES - EJECT.
4. If fire cannot be confirmed - LAND ASAP.

If the warning light goes out and no evidence of fire exists, land as soon as practicable. Do not attempt to restart. After engine shutdown, attempt to verify the presence of fire by checking for other indications such as smoke in cockpit, nacelle smoke or smoke trailing behind the aircraft or verification from ground or another aircraft. If corrective action has not extinguished the fire, EJECT.

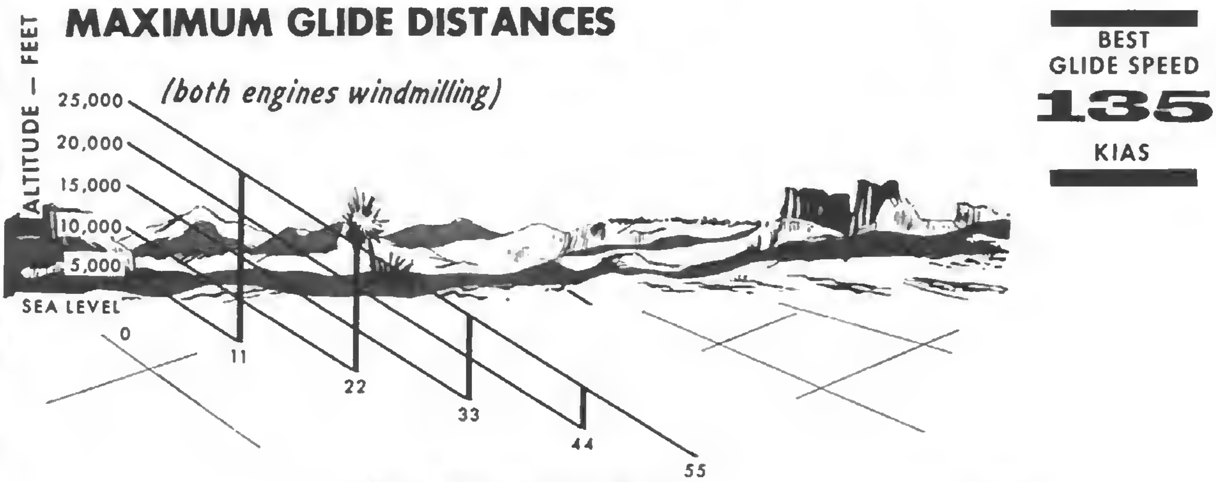
Note

If fire detect warning light extinguishes after remedial action, actuate test circuit to determine if circuit is still functional. If test circuit fails to illuminate light, continue investigation for actual fire.

ELECTRICAL FIRE

If fuselage, wing, or electrical fire occurs, turn off all electrical equipment. If fire continues out of control, EJECT if conditions permit.

1. Battery and generator switches - OFF.
2. Land as soon as possible.



Note

SPEED WILL INCREASE WITH HIGHER GROSS WEIGHT UP TO 5 KIAS BUT ALTITUDE VS DISTANCE WILL BE APPROXIMATELY AS SHOWN.

Note

FOR MAXIMUM GLIDE DISTANCE KEEP GEAR, FLAPS, SPEED BRAKE RETRACTED AND JETTISON EXTERNAL STORES.

Figure 3-1

SMOKE AND FUME ELIMINATION

WARNING

All odors not identifiable by flight crew shall be considered toxic. Immediately initiate SMOKE AND FUME ELIMINATION procedures and land as soon as possible. Do not takeoff when unidentified odors are detected.

In the event smoke or fumes enter the cockpit during flight, the following procedure should be used:

1. OXYGEN - 100%.
2. Check for presence of fire.
3. Bleed air switches - OFF.
4. Battery and generator switches - OFF.

Note

Turn both the battery and generator switches OFF until it is determined the smoke is not caused by a short in the electrical system.

If smoke is severe and continued flight is anticipated, jettison canopy if necessary.

5. Ram air lever - OPEN.
6. Canopy - JETTISON (if necessary).
7. Land - AS SOON AS POSSIBLE.

CAUTION

Smoke may be encountered in the cockpit after negative "G" flights due to oil siphoning from the engine. A landing should be made as soon as practical in order to check the oil level and identify the source of the smoke

MAXIMUM GLIDE

For the maximum distance this aircraft will glide with clean configuration, both engines windmilling, see figure 3-1.

EJECTION VS FORCED LANDING

Because of the many variables encountered, the final decision to attempt a flameout landing or to eject must remain with the pilot. It is impossible to establish a predetermined set of rules and instructions which would provide a ready-made decision applicable to all emergencies of this nature. The basic conditions listed below, combined with the pilot's analysis of the condition of the aircraft, type of emergency, and his proficiency are of prime importance in determining whether to attempt a flameout landing or to eject. These variables make a quick and accurate decision difficult. If the decision is made to eject, prior to ejection, if possible, the pilot should attempt to turn the aircraft toward an area where injury or damage to persons or property on the ground or water is least likely to occur. Before a decision is made to attempt a flameout landing, the following basic conditions should exist.

Note

The A-37B has the capability of positive control throughout its flight and glide characteristics since it contains no power actuated control surfaces.

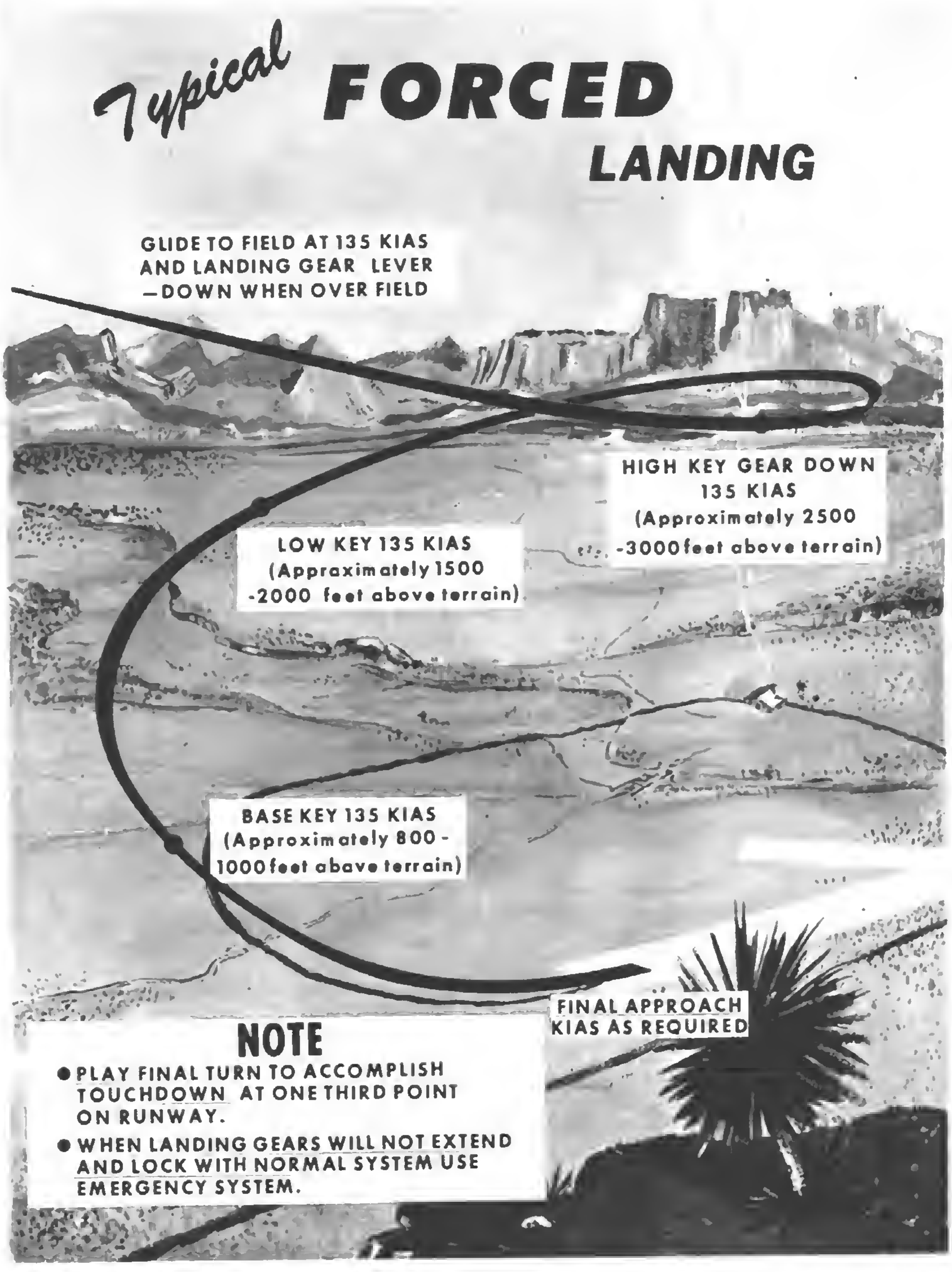

Typical FORCED LANDING
GLIDE TO FIELD AT 135 KIAS AND LANDING GEAR LEVER —DOWN WHEN OVER FIELD
HIGH KEY GEAR DOWN 135 KIAS (Approximately 2500 -3000 feet above terrain)
LOW KEY 135 KIAS (Approximately 1500 -2000 feet above terrain)
BASE KEY 135 KIAS (Approximately 800 - 1000 feet above terrain)
FINAL APPROACH KIAS AS REQUIRED
NOTE
● PLAY FINAL TURN TO ACCOMPLISH TOUCHDOWN AT ONE THIRD POINT ON RUNWAY.
● WHEN LANDING GEARS WILL NOT EXTEND AND LOCK WITH NORMAL SYSTEM USE EMERGENCY SYSTEM.

Figure 3-2

1. Flameout landing should only be attempted by pilots who have satisfactorily completed simulated flameout approaches in the aircraft.
2. Weather, terrain, conditions and lighting conditions must be favorable. Cloud cover, visibility, turbulence, surface wind, etc., must not impede in any manner the establishment of proper flameout landing pattern.
3. Flameout landings should only be attempted when either a satisfactory "High Key" or "Low Key" position can be achieved.
4. If at anytime during the flameout approach, conditions do not appear ideal for successful completion of the landing, ejection should be accomplished. EJECT no later than 2000 feet AGL.

AIRSTART ATTEMPTS DURING FLAMEOUT LANDING PATTERN

In the event of a double engine flameout:

1. Attempt to complete all airstart efforts before high key is reached so that full attention may be devoted to accomplishing a successful flameout landing.
2. If the circumstances of flameout have precluded conclusive airstart attempts prior to high key, further airstarts may be attempted but primary attention should be devoted to proper execution of the flameout landing.

FORCED LANDING (NO POWER)

In the event both engines flameout during flight and airstarts are unsuccessful or not deemed advisable and the pilot does not elect to eject, the following should be accomplished. See figure 3-1, Maximum Glide Distances, and figure 3-2, Typical Forced Landing Pattern.

1. Establish glide - 135 KIAS.
   The landing gear, wing flaps and speed brake may be raised, if necessary, to increase maximum glide distance.
2. External stores - JETTISON.
3. Tip fuel switches - DUMP (discontinue prior to landing).
4. Shoulder harness lever - LOCK (if desired).
5. Landing gear lever - DOWN.
   The landing gear should be lowered over the field or at high key. Airspeed 135 KIAS after landing gear is down.

WARNING

Retention of the canopy is recommended during a forced landing. It will afford protection against fire, smoke, flying objects, and barrier cables or wires. The inability to open the canopy by electrical means, manual means, or by jettisoning is remote. Normal canopy opening should be attempted before jettisoning.

CAUTION

Directional control must be maintained by use of wheel brake only, as nose wheel steering will not be available when making a forced landing with both engines inoperative.

Note

- Emergency landings shall be made with landing gear extended. This also applies to overshooting or undershooting prepared runways when touchdowns cannot be avoided.
- The helmet visor should be in the down position to decrease the possibility of injury.
- For a simulated forced landing, lower speed brake and adjust throttles to 50% rpm.
- The forced landing pattern should be planned as a no-flap pattern, as hydraulic pressure may not be available to lower flaps. To prevent landing long, if the engines are not seized, flaps may be lowered just prior to touchdown, by motoring an engine with the engine start switch and increasing hydraulic pressure.
- An airspeed of 135 KIAS during the forced landing pattern provides the optimum glide speed for that configuration. Any deviation from 135 KIAS will result in an increased rate of descent.
- The base key position can be adjusted to compensate for excess altitude in the pattern. If additional altitude must be lost, a slip is recommended. Full rudder deflection may be used.

SPINS

SPIN RECOVERY

One procedure should recover the aircraft from any spin under all conditions. In case of inadvertent spin entry, proceed as follows:

1. THROTTLES - IDLE.

WARNING

If throttles are not retarded to idle, dual engine flameout may occur. A normal spin recovery may still be made.

2. CONTROLS - NEUTRAL.
3. STICK - ABRUPTLY FULL AFT AND HOLD.
   a. If the spin is inverted, a rapid and positive recovery will be affected within one turn.
   b. If the spinning stops, neutralize controls and recover from the ensuing dive.

c. If spinning continues, the aircraft must be in an erect normal spin (it cannot spin inverted or accelerated if the controls are moved abruptly to this position). Determine the direction of rotation using the turn needle (turn needle will be deflected in the direction of the spin) and outside references before proceeding with the following steps:

4. RUDDER - ABRUPTLY FULL OPPOSITE TURN NEEDLE.

WARNING

Spins can be disorienting. Therefore, it is imperative that the correct direction of rotation be determined by *reference to the turn needle* before continuing the recovery procedure. If rudder in the direction of spin is used during an attempted recovery, the rotation rate will increase when the stick is moved forward and recovery will not occur if these control positions are held.

5. STICK - ABRUPTLY FULL FORWARD ONE TURN AFTER APPLYING RUDDER.
   a. As the nose pitches down, relax forward pressure while continuing to hold rudder until spinning has stopped. Do not allow the stick to move aft of neutral until recovery is effected.
   b. Recovery should be accomplished within one and one-half turns from the point at which recovery rudder was applied.

WARNING

One of the major reasons for missing a recovery is not waiting long enough after the recovery controls have been initiated.

Note

If forward stick is applied before rudder effectiveness is obtained, the spin will momentarily speed up and recovery will take slightly longer.

6. CONTROLS - NEUTRAL AFTER SPINNING STOPS.
   When spinning stops, neutralize the controls and recover from the ensuing dive.

WARNING

- If a spin is entered at less than 10,000 feet AGL or if recovery from a spin entered at higher altitude has not been completed by the time you pass 10,000 feet AGL, EJECT.
- The characteristics of the spin and the effectiveness of the recovery procedure will vary: (1) If the stick is not held full aft with rudder neutral during the spin; (2) If the aircraft is spun with over 70 pounds asymmetric wing fuel; (3) If the application of recovery controls is not executed briskly; (4) If the recovery procedure is varied so that less than full rudder or full-down elevator is obtained; (5) If forward stick is applied before rudder effectiveness is obtained.

CAUTION

If a landing configuration spin is entered inadvertently, both gear and flaps should be retracted as soon as possible after recovery to prevent excessive structural loads.

Note

- It is not necessary to relax the forward pressure after the nose pitches down in order to effect recovery; however, if the stick is held forward, the aircraft attitude upon recovery can be past the vertical. In this position, the aircraft will transition into an inverted spin unless controls are neutralized immediately.
- See Section VI for discussion of spin characteristics.

SPIN RECOVERY CHARACTERISTICS

Landing configuration spins are not recommended as practice maneuvers. However, if entered inadvertently, use the normal single recovery procedure.

Recovery characteristics using the single recovery procedure are as follows:

Normal Spins

From an initial condition of stick aft and rudder in the direction of spin, the nose will lower slightly when the rudder is neutralized and, initially, the rotation rate will increase slightly; then as the neutral rudder becomes effective, the rotation rate will decrease slightly and remain constant. When rudder opposite to the direction is applied, the nose drops slightly and the apparent rotation rate will increase slightly. After approximately one-half turn, the apparent rotation rate will be constant or decreasing slightly; aircraft buffet may be apparent. Full rudder effectiveness will be developed by one full turn. As the forward stick is applied, the nose drops sharply and rotation will stop within one-half to one turn from this point. If the forward stick pressure is eased off as the nose pitches down, the dive angle will not become excessive. The aircraft attitude after the rotation stops is usually a near vertical dive. With external stores installed the attitude is nose low and near the vertical dive, however, there are yawing motions present that swing the nose just after rotation stops and just prior to starting the dive recovery. Although undesirable, there is no apparent tendencies to enter another spin as a result of this residual yawing motion. The altitude lost from initiation of recovery (opposite rudder) until the altimeter was stopped will be approximately 3500 to 4500 feet. The altitude lost during recovery

EJECTION PROCEDURE

BEFORE EJECTION IF TIME AND CONDITIONS PERMIT:

1. IFF - EMERGENCY.
2. Notify appropriate ground agency of ejection (include type of aircraft, number of occupants, location and altitude).
3. Stow all loose equipment.
4. Seat adjustment lever - LOCKED.
5. Actuate bailout oxygen bottle.
6. Attain proper airspeed, altitude and attitude.
7. Pull helmet visor down.
8. Attain correct body position. Place feet firmly on floor, sit erect with head hard against headrest and chin tucked in.

EJECTION:

1. ORDER CREW MEMBER TO EJECT.
2. ARMING HANDLES - RAISE.
3. TRIGGER - SQUEEZE.

   Do not pull trigger and handle up at the same time. If this occurs release the trigger, then continue.

   Look if necessary to be assured trigger is being squeezed and not just the arming handle, then reposition body.

AFTER EJECTION:

1. Immediately after ejection, attempt to open seat belt.
2. Release arming handles and kick free.
3. If above 14, 000 feet, pull parachute arming lanyard knob.
4. If below 14, 000 feet, pull parachute rip cord handle.

   If automatic seat belt operates properly and parachute arming lanyard is connected, parachute will open one second after seat separation if below 14, 000 feet or at 14, 000 feet if ejection occurs above that altitude.

Note

If automatic seat belt fails, automatic features of parachute will be lost. Open seat belt manually.

Figure 3-3

will vary with pilot technique in applying recovery controls, pilot technique during the pull-out, aircraft configuration and gross weight. In all cases, precise and brisk control inputs will produce the most positive recovery.

Accelerated Spins

From any control position neutralize the rudder and briskly move the stick full aft and hold. As the stick is moved full aft, the nose raises and the rotation rate will start to decrease. The decrease in rotation rate may not be immediately apparent. However, it should be emphasized that as soon as this control position has been established, the aircraft immediately transitions to a normal condition for recovery, i. e., a normal spin recovery (opposite rudder for one turn and forward stick) can then be made without further delay. Using the proper recovery controls will result in a recovery within two turns after opposite rudder is applied.

Inverted Spins

With the aircraft spinning inverted, neutralize rudder and move the stick full aft. A rapid and positive recovery will occur within one-half turn. The aircraft rolls rapidly into an erect stalled condition and rotation stops within one-half turn. When rotation has definitely stopped, ease forward on the stick and break the stall. The aircraft can be held in the stalled condition for prolonged periods of time; however, if it is held in the stall long enough, it may eventually fall into a normal spin. Although the recovery is very abrupt, it is not excessively violent and is well within the structural limits of the aircraft. The altitude lost from initiation of the recovery (full aft stick) until the altimeter stops is approximately 4000 feet. The altitude lost during recovery will vary greatly as described under normal spins.

EJECTION

The following information should be observed when ejection must be accomplished. To eject follow the ejection procedure.

1. IFF - EMERGENCY.
2. Under level flight conditions, eject at least 2000 feet above the terrain whenever possible.

WARNING

Do not delay ejection below 2000 feet above the terrain in futile attempts to start the engine or for other reasons that may commit you to an unsafe ejection or a dangerous flameout landing. Accident statistics emphatically show a progressive decrease in successful ejections as altitude decreases below 2000 feet above the terrain.

3. Under spin or dive conditions, eject at least 10, 000 feet above the terrain whenever possible.
4. Attempt to slow the aircraft as much as practical prior to ejection by trading airspeed for altitude.
   a. Below 120 KIAS, airflow is insufficient to affect rapid parachute deployment. Therefore, it becomes extremely important during low altitude ejection to obtain at least 120 KIAS, if possible, to assure more rapid parachute deployment.
   b. During high altitude ejection, observing this minimum airspeed (120 KIAS) becomes less important since time (altitude) for parachute deployment is a much less important factor.
5. If the aircraft is not controllable, ejection must be accomplished at whatever speed exists, as this offers the only opportunity for survival. At sea level wind blast will exert minor forces on the body up to about 525 KIAS.
6. The automatic safety belt must not be opened manually before ejection, regardless of altitude. If the automatic seat belt is opened manually, the automatic opening feature of the parachute is eliminated and seat separation may be too rapid at high speeds.

LOW ALTITUDE EJECTION

During any low altitude ejection, the chances for successful ejection can be greatly increased by zooming the aircraft (if airspeed permits) to exchange airspeed for altitude. Ejection should be accomplished while the aircraft is in a positive climb. This will result in a more nearly vertical trajectory for the seat and crew member thus providing more altitude and time for seat separation and parachute deployment.

Emergency Minimum Ejection Altitudes

WARNING

Emergency minimum ejection altitudes quoted were determined through extensive flight test and are based on distance above terrain on initiation of seat ejection (i. e., time seat is fired). These figures do not provide any safety factor for such matters as equipment malfunction, delays in separating from the seat, etc. These figures are quoted only to show the minimum altitude above the terrain that must be achieved in the event of such low-altitude emergencies as fire on takeoff. They must not be used as the basis for delaying ejection when above 2000 feet, since accident statistics show a progressive decrease in successful ejections as altitude decreases below 2000 feet. Therefore, whenever possible, eject above 2000 feet. When

ejecting under controlled conditions at more than 2000 feet above the ground disconnect the zero-delay lanyard. To insure survival during extremely low-altitude ejections, the automatic features of the equipment must be used and depended upon.

BA-15, BA-18 or BA-22 Back Pack/C-9 Canopy

1. With F-1B Timer (1 Second Parachute) 200 feet.
2. With Zero-Delay Lanyard Connected to Parachute Rip Cord Handle (0 Second Parachute) 100 Feet.

ZERO-DELAY LANYARD CONNECTION REQUIREMENTS

The zero-delay parachute lanyard will be connected and disconnected as follows:

1. Connect prior to takeoff.
2. Leave connected at all times below 10, 000 feet pressure altitude including flights in which 10, 000 feet may be temporarily exceeded.

Note

If operating above terrain over 8000 feet high, the zero-delay lanyard should remain connected until the aircraft is at least 2000 feet AGL.

3. Disconnect when passing through 10, 000 feet pressure altitude when this altitude will be exceeded for prolonged periods.
4. Connect prior to initial penetration, or at 10,000 feet pressure altitude during enroute descent.

EJECTION IF CANOPY FAILS TO JETTISON

If the canopy does not jettison when the seat arming handles are raised, an attempt should be made to release the canopy by pulling the canopy jettison "T" handle, or positioning the canopy downlock lever in the UNLOCKED position and attempt to raise canopy by pulling the canopy de-clutch handle. If the canopy cannot be jettisoned by any of the above procedures, the seat can be ejected through the canopy; this should be a last resort method and should only be attempted after all manual or electrical attempts at opening the canopy have failed.

BAILOUT IF SEAT FAILS TO EJECT

If ejection seat fails to eject when the trigger in the right arming handle is squeezed, a manual bailout will be required. If the aircraft is not controllable, bailout by diving over the trailing edge of the wing. If the aircraft is controllable, proceed as follows:

1. Bailout bottle - ACTUATE.
2. Personal equipment leads - DISCONNECT.
3. Trim - NOSE DOWN.
4. Safety belt - UNFASTEN and release stick.
5. Parachute arming lanyard or D-ring - PULL.

WARNING

After canopy has been jettisoned, purposely or otherwise, and seat ejection has not been accomplished, no attempt should be made to place the arming handles back down. The arming handles are held in the up position by means of a mechanical lock. In the event of damaged firing devices, any movement of the arming handles or trigger might jettison the seat with possible injury to the person attempting such action.

NOSE ACCESS DOOR OPENING IN-FLIGHT (HIGH AIRSPEED)

The opening of an unlatched or improperly adjusted nose access door is related to the angle-of-attack of the aircraft. Nose access door openings have occurred at high angle of attack with both low and high airspeeds. Openings have also occurred during takeoffs, approaches and landings. If nose access door comes open at high airspeed:

1. Throttles - IDLE.
2. Speed brake switch - OUT.
3. Establish level flight.

CAUTION

If nose access door opens at high airspeed, severe buffeting and structural damage may occur. The aircraft speed should be reduced as rapidly as possible without pulling G's as an increased angle-of-attack will cause the door to open wider.

If the door closes then begins to open again as speed is reduced:

4. Maintain an airspeed at which the door will remain closed.
5. Avoid any abrupt changes in pitch attitude.
6. Land as soon as practicable.
7. Final approach speed - 20 KIAS above normal.

Experience indicates that the door will probably begin to open at 120 to 130 KIAS as airspeed is decreased and will be fully open at 90 KIAS. Use a straight-in approach with gentle turns and smooth control techniques. Fly the aircraft down very close to the runway. Do not attempt to spike the aircraft on the runway.

ON TAKEOFF

If the nose access door opens on takeoff, the takeoff should be aborted if sufficient runway remains. If takeoff is continued, maintain an airspeed that will keep the door closed and land as soon as possible using procedures previously described.

CANOPY UNLOCKED OR LOST DURING FLIGHT

If the canopy was not locked prior to takeoff, the canopy will begin to open shortly after takeoff, and may separate from the aircraft if airspeed is allowed to increase. If the canopy is lost, make a straight-in approach maintaining a minimum of 120 KIAS on final. If the canopy-not-locked warning lights is observed to be illuminated during flight, or it is obvious the canopy is not properly locked or opening during flight, the following procedure will apply:

1. Slow to 120 KIAS minimum while avoiding abrupt pitch changes.

WARNING

Avoid flying over populated areas.

Note

Speed brake should not be lowered to reduce airspeed. Retard throttles slowly to reduce airspeed without making abrupt pitch changes.

2. Canopy control switch - EXTERNAL.

Note

The internal canopy control switch is inoperative unless the canopy downlock handle is in the UNLOCK position.

3. Land immediately. Make a straight-in approach. Maintain 120 KIAS minimum, using shallow turns.

CAUTION

Do not touch canopy downlock handle until landing roll is completed.

RUNAWAY TRIM

1. Airspeed - 120 to 150 KIAS.
2. Attempt use of trim button on opposite control stick. If trim is regained, do not trim again unless the extreme condition recurs.

WARNING

At speeds above 300 KIAS runaway nose down trim is uncontrollable. Immediate reduction of airspeed to regain control of the aircraft is required.

Note

- If the nose has pitched up to a dangerous attitude, add power and roll the aircraft into a banked attitude to bring the aircraft back to level flight.

- If the trim tab fluctuates from stop to stop, accomplish the procedure for runaway trim and attempt to turn off battery and generator switches at a position as near neutral trim as possible.

Note

After the aircraft is under control, pull the applicable trim circuit breaker and turn battery and generator switches back on.

LANDING

WARNING

When landing with an emergency situation, live ordnance should be jettisoned prior to landing to reduce gross weight and lessen the fire/explosive hazard after landing.

LANDING WITH ONE ENGINE INOPERATIVE

Single engine landings can be made using procedures similar to those used for two engine operation. Careful planning should be used to make the first attempt successful, since recovery from an aborted landing with single engine power requires more time and distance. Turns should be more shallow than normal. The normal overhead pattern should be flown. The airspeed on final approach should be 100 KIAS minimum. At gross weights over 7,500 pounds add +6.5 KIAS per 1,000 pounds.

CAUTION

If porpoising occurs upon touchdown, do not increase power on good engine because the unequal thrust will make directional control difficult. Position and hold controls to establish normal landing attitude. Do not attempt to counteract each bounce with opposite stick movement.

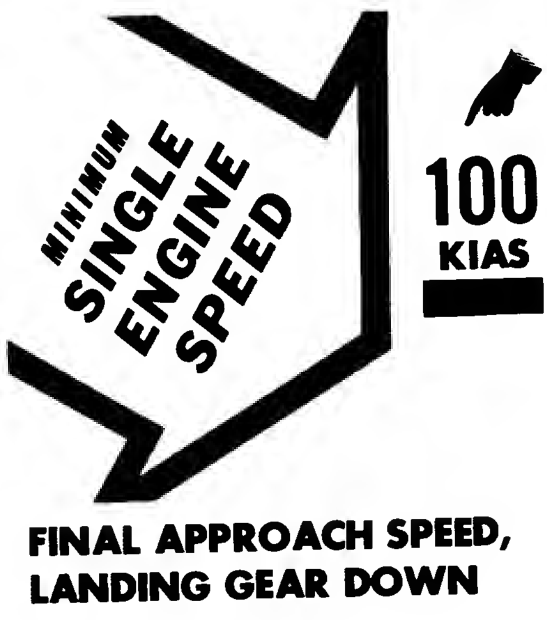


Figure 3-4

STRUCTURAL DAMAGE

If structure damage occurs in flight, the pilot must decide whether to leave the aircraft or attempt a landing. Determine the controllability by procedures established in "Landing with Asymmetric Load" in this section.

HYDRAULIC POWER SUPPLY SYSTEM FAILURE

Hydraulic system failure will be indicated by a loss of pressure on the hydraulic pressure indicator. As soon as hydraulic system failure is detected during flight, a landing should be made as soon as practicable. If a complete hydraulic failure occurs, the flaps, speed brake, spoilers, thrust attenuators, and nose wheel steering will be inoperative. Landing gear extension will have to be made by using the emergency air system.

1. Lower gear pneumatically.
2. Land as soon as practicable.

LANDING GEAR EMERGENCY EXTENSION (HYDRAULIC FAILURE)

In case of a complete hydraulic system failure, the landing gear can be lowered with the emergency system as follows:

1. Airspeed - 150 KIAS or below.
2. Gear handle - DOWN.

Note

If landing gear lever will not lower, attain sufficient altitude and attempt to lower the lever while maintaining slight negative G's.

3. Landing gear emergency T-handle - TURN, PULL.

CAUTION

- Do not pull emergency landing gear T-handle unless landing gear lever is in the down position. Damage to landing gear and aircraft may result.

- To prevent rupturing of the hydraulic reservoir, do not attempt to recycle landing gear after actuating emergency system. Rupturing of hydraulic reservoir could result in an in-flight fire.

4. Landing gear indicators - CHECK.

LANDING GEAR EMERGENCY EXTENSION (ELECTRICAL FAILURE)

In case one or both of the main landing gear remain retracted when the gear handle is placed in the down position and the hydraulic pressure indicates normal, an electrical malfunction may exist. Proceed as follows:

1. Airspeed - 150 KIAS or below.
2. Gear handle - DOWN.
3. Gear sequence circuit breaker - PULL.

Note

If the circuit breaker cannot be pulled out, turn off both generators and the battery.

4. Wait 15 seconds and then restore electrical power.
5. Landing gear indicators - CHECK.

LANDING WITH ANY GEAR UP OR UNLOCKED

If a condition exists in which one or more landing gear remains up or indicates unlocked, make a straight-in approach with whatever landing gear can be extended or partially extended and proceed as follows:

1. Request runway be foamed, time permitting.

WARNING

If time permits, have runway foamed to reduce possible damage to the aircraft and fire hazard.

2. Armament - Selectively DROP.
3. Tip fuel switches - DUMP.
4. Retain pylon tanks, if empty.
5. Seat arming handle safety pin - INSTALLED.
6. Shoulder harness - LOCK.
7. Speed brake switch - OUT.
8. Flap handle - DOWN.
9. After touchdown, if any gear is up or collapses - SHUTDOWN ENGINES.
10. Battery switch - OFF (if necessary).

Note

If conditions permit do not turn battery off after aircraft stops because speed brake will retract and cause further damage.

LANDING GEAR EMERGENCY "T" HANDLE

Figure 3-5

11. Landing gear safety pins - INSTALLED.

WARNING

Retention of the canopy is recommended. It will afford protection against fire, smoke, flying objects, and barrier cables or wires. The inability to open the canopy by electrical means, manual means, or by jettisoning is remote. Normal canopy opening should be attempted before jettisoning.

Note

- If a nose gear malfunction occurs, holding it off the runway can be aided by trimming the elevator full nose down. Do not use brakes until the nose wheel is on the runway and then only as necessary to maintain directional control.
- If a main gear malfunction occurs, land on the side of the runway corresponding to the extended gear. Hold retracted or unlocked gear off as long as possible. Use brake on lowered gear and nose wheel steering to maintain directional control.

DITCHING

Eject rather than ditch this aircraft. All emergency survival equipment is carried by the pilot, consequently, there is no advantage of staying with the aircraft.

LANDING WITH A FLAT TIRE

If a flat tire occurs on takeoff with insufficient runway remaining to abort, leave landing gear extended and land as soon as practicable. If nose tire is flat, hold nose gear off the runway until just prior to losing elevator control. After touchdown, trim elevator full nose down to assist holding nose tire off runway. Use nose wheel steering and brakes for directional control. With one main tire flat, land on the side of the runway corresponding to the good tire. Use brakes and nose wheel steering for directional control.

LANDING WITH ASYMMETRICAL LOAD.

Refer to Section VI for additional information.

In the event of an asymmetrical load in excess of 50,000 inch-pounds, due to trapped fuel or inability to jettison a particular store, proceed as follows:

1. Attempt to reduce or balance asymmetrical loads.
2. At a safe altitude, determine the minimum control speed in landing configuration. Do not attempt to land if minimum control speed is above 110 KIAS. Do not continue the controllability check below 100 KIAS.
3. If minimum control speed is between 100 KIAS and 110 KIAS, attempt landing only under ideal conditions.

If decision is made to land:

1. Fly a power on, straight-in approach with final approach speed 20 KIAS above minimum control speed. Use as little flare as possible and make a normal touchdown. Touchdown on the side of the runway away from the heavy wing.

WARNING

Maximum touchdown speed is 125 KIAS with full flaps and 135 KIAS with no flaps, to avoid nosewheel first touchdowns.

2. After touchdown, lower the nosewheel to the runway and engage nosewheel steering. Shutdown the engine away from the heavy wing if stopping distance or directional control becomes critical.

ASYMMETRICAL FLAP CONDITION

Attempt to correct an asymmetrical flap condition by retracting the wing flaps. If it is not possible to eliminate the asymmetrical flap condition, use rudder and ailerons as necessary to maintain aircraft control and land as soon as possible from a straight-in approach maintaining a minimum of 110 KIAS on final.

WHEEL BRAKE FAILURE

When making a landing with a wheel brake inoperative, land on the side of the runway corresponding to the inoperative brake.

Note

Each brake master cylinder is independent. In case of wheel brake failure (during dual flight) check both sets of brake pedals.

After touchdown, use nose wheel steering and the good brake to maintain directional control and stop the aircraft. (If both wheel brakes fail, use maximum aerodynamic braking upon landing.) As a last resort, in the event of imminent contact with obstructions, press the emergency override switch and raise the landing gear lever to the UP position.

WARNING

Avoid contacting raised barriers.

MISCELLANEOUS

FLOAT VALVE MALFUNCTION OR ILLUMINATION OF FUEL BOOST PUMP WARNING LIGHT

Illumination of the fuel boost pump warning light may be an indication of a failed boost pump or a malfunc-

tion of the float switches in the fuselage tank. If the float switches have malfunctioned, the first indication of impending double engine flameout due to fuel starvation may be an increase on the fuel quantity indicator. This will be followed by fuel flow fluctuations on both engines and illumination of the fuel boost pump warning light.

Double engine flameout will occur within a few seconds depending on power settings.

If the fuel boost pump warning light illuminates during normal flight or fuel depletion of the fuselage tank is suspected, accomplish the following:

1. Fuel system switch - GRAVITY.
2. Reduce both throttles to 80% RPM or below.
3. Descend rapidly to 15, 000 feet MSL or below (if practicable).
4. Do not perform negative "G" maneuvers.
5. If light remains on, land as soon as practicable.

WARNING

- If the boost pump is inoperative, the engines may flame out during negative "G" flying conditions. An airstart may be prevented by an air lock.
- In the event of double engine flameout with boost pump inoperative, only battery power will be available for engine restart.

Note

- The fuel boost pump warning light may flicker momentarily near zero "G" conditions due to a momentary lack of fuel at the boost pump inlet. This conditions is normal.
- Limited testing indicates that normal operation at 100% power may be expected without boost pump operation as high as 23, 000 feet. However, engine manufacturers specifications do not guarantee operation above 6000 feet without boost pump.

GENERATOR FAILURE

If both generators fail or one generator fails, as indicated by the generator warning lights, and battery power is still available, turn off all non-essential electrical equipment to conserve battery.

1. Affected generator switch - OFF.
2. Land as soon as practicable.

CAUTION

In the event of generator failure, continued operation of the affected engine could result in generator disintegration.

INVERTER FAILURE

Inverter failure can be detected by observing the inverter out warning light. (See figure 1-14.) If the attitude indicator, BDHI, fuel quantity gage, or fuel flowmeters cease to function, place the inverter switch in the SPARE position, and the warning light will go out.

COMPLETE ELECTRICAL FAILURE

Complete electrical failure is evidenced by a zero reading from both loadmeters and failure of all electrically operated equipment. This condition primarily arises because of failure of the generators. The battery will not support the heavy load required for normal flight. The important things to remember are:

1. Fuel boost pump will be inoperative.
2. All electrical indicators and warning systems will be inoperative.
3. Neither the lights nor any of the radios will operate.
4. Speed brake, spoilers, thrust attenuators and nose wheel steering cannot be operated.
5. Fuel system will automatically be on gravity feed system.
6. Trim tabs will remain as set prior to electrical failure.
7. External load cannot be jettisoned or dropped without electrical power.
8. Engine inlet screens will go to the down position.

WARNING

Instrument flying is impossible, because all radio communication equipment and essential flight instruments will be inoperative.

The following will be available:

1. Engine operation.
2. Flap operation.

Note

With a complete electrical failure the flaps will be operative but the flap position indicator will be inoperative.

3. Internal fuel.
4. Normal and emergency gear extension.

In the event of complete electrical failure proceed as follows:

1. Reduce both throttles to 80% RPM or below.
2. Descend rapidly to 15, 000 feet MSL or below (if practicable).
3. Land as soon as practicable.

HIGH LOADMETER READING

Continued operation at idle or battery engine starts may result in loadmeter reading above 0. 5. If one or

EMERGENCY ENTRANCE

WARNING

WHEN JETTISONED, THE CANOPY WILL FALL IN THE IMMEDIATE AREA AFT OF THE AIRPLANE.

Figure 3-6

both loadmeters show a reading above 0.8 during first 10 minutes of flight or 0.5 thereafter, proceed as follows:

1. Battery switch - OFF.
2. Loadmeter - CHECK.
   If loadmeter returns to normal, battery is faulty. Leave battery switch OFF and land as soon as possible.

If loadmeter remains high:

3. Battery switch - ON.
4. Inverter switch - SPARE.
5. Both generator switches - OFF.
6. All electrical equipment - OFF (except boost pump).
7. Monitor loadmeters while turning generators ON. Turn each electrical accessory ON, one at a time, until faulty system is located. Turn defective unit OFF unless it is essential for flight, and land as soon as practicable.

Note

A high loadmeter reading usually results in battery failure, battery burning, battery explosion and/or complete electrical failure.

ZERO LOADMETER READING

If a loadmeter indicates a zero reading, proceed as follows:

1. Opposite generator switch - OFF.
2. Battery switch - OFF.
   If electrical accessories continue to operate, the loadmeter is inoperative.
3. Battery and opposite generator switch - ON, if loadmeter is inoperative and continue mission.
4. If accessories fail when battery and opposite generator switches are OFF, generator is inoperative.
5. Battery and opposite generator switch - ON, if generator is inoperative.
6. Land as soon as practicable.

HIGH VOLTMETER READING

1. Turn off individual generators to determine the malfunctioning generator and/or voltage regulator.
2. Leave defective unit off.

ENGINE OIL SYSTEM FAILURE

If an oil system malfunction (as evidenced by high or low oil pressure) has caused prolonged oil starvation

of engine bearings, the result will be a progressive bearing failure and subsequent engine seizure. This progression of bearing failure starts slowly and will normally continue at a slow rate up to a certain point at which the progression of failure accelerates rapidly to complete bearing failure. The time interval from the moment of oil starvation to complete failure depends on such factors as: condition of the bearings prior to oil starvation, operating temperature of bearings, and bearing loads. A good possibility exists for 10 to 30 minutes of operation after experencing a complete loss of lubrication oil. Bearing failure due to oil starvation is generally characterized by a rapidly increasing vibration. When the vibration becomes moderate to heavy, complete failure is only seconds away and in most instances the pilot will increase his chances of a successful ejection or single engine landing by shutting down the affected engine. Since the end result of oil starvation is engine seizure, the following procedures should be observed in an attempt to forestall engine seizure as long as possible. At first sustained indication of oil system malfunction (see Section V for oil system operating limitations) proceed as follows:

1. Affected engine - SHUTDOWN IMMEDIATELY (conditions permitting).

SECTION IV

CREW DUTIES

CREW DUTIES

Crew duties are not applicable in this aircraft.

SECTION V

OPERATING LIMITATIONS

TABLE OF CONTENTS

OPERATING LIMITATIONS

This section includes aircraft and engine limitations which must be observed during normal operation. These limitations are derived from extensive wind tunnel and flight testing to insure your safety and to help obtain maximum utility from the equipment. The instrument dials are marked as shown in figure 5-1 as a constant reminder of airspeed and engine limitations; however, additional limitation on operational procedures, aerobatics and aircraft loading are given in the following paragraphs.

FLIGHT RESTRICTIONS

Abrupt roll checks with tip tank fuel are not permissible at speeds above 280 KIAS. There is no limitation when the tip tanks are empty.

MINIMUM CREW REQUIREMENTS

The minimum crew requirement for this aircraft is one pilot in the left seat.

INSTRUMENT MARKINGS

Cognizance must be taken of the instrument markings as shown in figure 5-1, since they represent limitations that are not necessarily repeated elsewhere in the text.

ENGINE LIMITATIONS

Engine limitations are shown in figure 5-1.

ENGINE RPM LIMITATIONS

100 ±1% rpm - limits for full throttle operation.
103% rpm - overspeed limit.
80% rpm - minimum for engine anti-icing system operation.

Flight conditions during climbs and dive may result in temporary rpm increases. When these conditions occur, however, throttles should be adjusted to maintain engine speeds below 100% rpm. Operation of the engine in excess of 103% rpm constitutes an engine overspeed. Appropriate entry will be made in Form 781, indicating highest rpm, exhaust gas temperature and duration (in seconds) of overspeed above 103% rpm. It is recommended that a minimum of 80% rpm be used when check of anti-icing system is desired.

USE OF ALTERNATE FUELS

Note

- No performance retardation will be experienced when using any of the jet fuels referenced in the Servicing Chart, Section I. When using aviation gas, a 2% increase in specific fuel consumption and corresponding reduction in range can be expected.
- It is recommended, when prolonged use of an alternate fuel is anticipated, that the engine fuel density control be properly adjusted for the fuel being used.

EXCESSIVE ENGINE EXHAUST GAS TEMPERATURE

If temperature limits are exceeded in-flight, the throttles should be adjusted immediately to maintain the exhaust gas temperature within limits. Whenever the operating limits are exceeded, make appropriate entry in Form 781, indicating highest rpm, exhaust gas temperature, and duration (in seconds of overtemperature condition).

OIL SYSTEM LIMITATIONS

The J85-17A engine will vent oil during prolonged inverted flight and during transits from positive to negative G conditions. Do not exceed 30 transits from positive to negative G conditions per flight. Do not exceed 60 seconds total negative G per flight. When operating for extended periods on single engine, the operating engine should be alternated every 30 minutes to provide adequate lubrication and prevent excessive oil loss from the windmilling engine.

CAUTION

Excessive loss of engine oil may be detected by fluctuations in oil pressure. In event of oil pressure fluctuations in excess of ±2 psi proceed as directed under Engine Oil System Failure, Section III.

INSTRUMENT

The instrument setting is such that the maximum allowable airspeed pointer will move to indicate the limiting structural airspeed of 415 KIAS or airspeed representing limiting Mach No. of .70 indicated whichever occurs first.

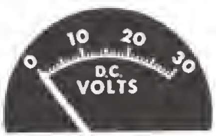
AIRSPEED △

170 KIAS gear down limit
156 KIAS landing lights limit
170 KIAS flaps - down limit

AIRSPEED △

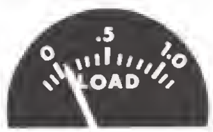
150 KIAS gear down limit
156 KIAS landing lights limit
170 KIAS flaps - down limit

△ AIRCRAFT 67-14776 THRU 70-1310 EXCEPT WHEN MODIFIED PER T.O. 1A-37B-555.
△ AIRCRAFT 70-1311 AND ON AND AIRCRAFT 67-14776 THRU 70-1310 WHEN MODIFIED PER T.O. 1A-37B-555.



VOLTMETER

22-29.5 VOLTS normal range



LOADMETER

.8 maximum for takeoff

.5 maximum after 10 minutes of flight

OPERATING LIMITATIONS DETERMINED USING GRADE JP-4 FUEL

TACHOMETER

48-98.5% RPM continuous operation

98.5-100% RPM maximum continuous 30 minutes

HYDRAULIC PRESSURE

1250-1550 PSI normal

1750 PSI maximum

Figure 5-1 (Sheet 1 of 2)

MARKINGS

EXHAUST GAS TEMPERATURE

280°C to 664°C continuous operation

280°C minimum for flight

692°C 30 minutes continuous operation

1000°C instantaneous limit for starting and acceleration

(900°C limited to 2 seconds)

OPERATING LIMITATIONS DETERMINED USING GRADE JP-4 FUEL

OIL PRESSURE

5-55 PSI normal operating range
(20 PSI minimum 100% RPM)

5 PSI minimum idle

55 PSI (maximum)

NOTE

Over ±2 PSI fluctuation or 10 PSI change from steady state is cause for abort.

ACCELEROMETER

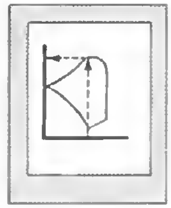
+6 G maximum

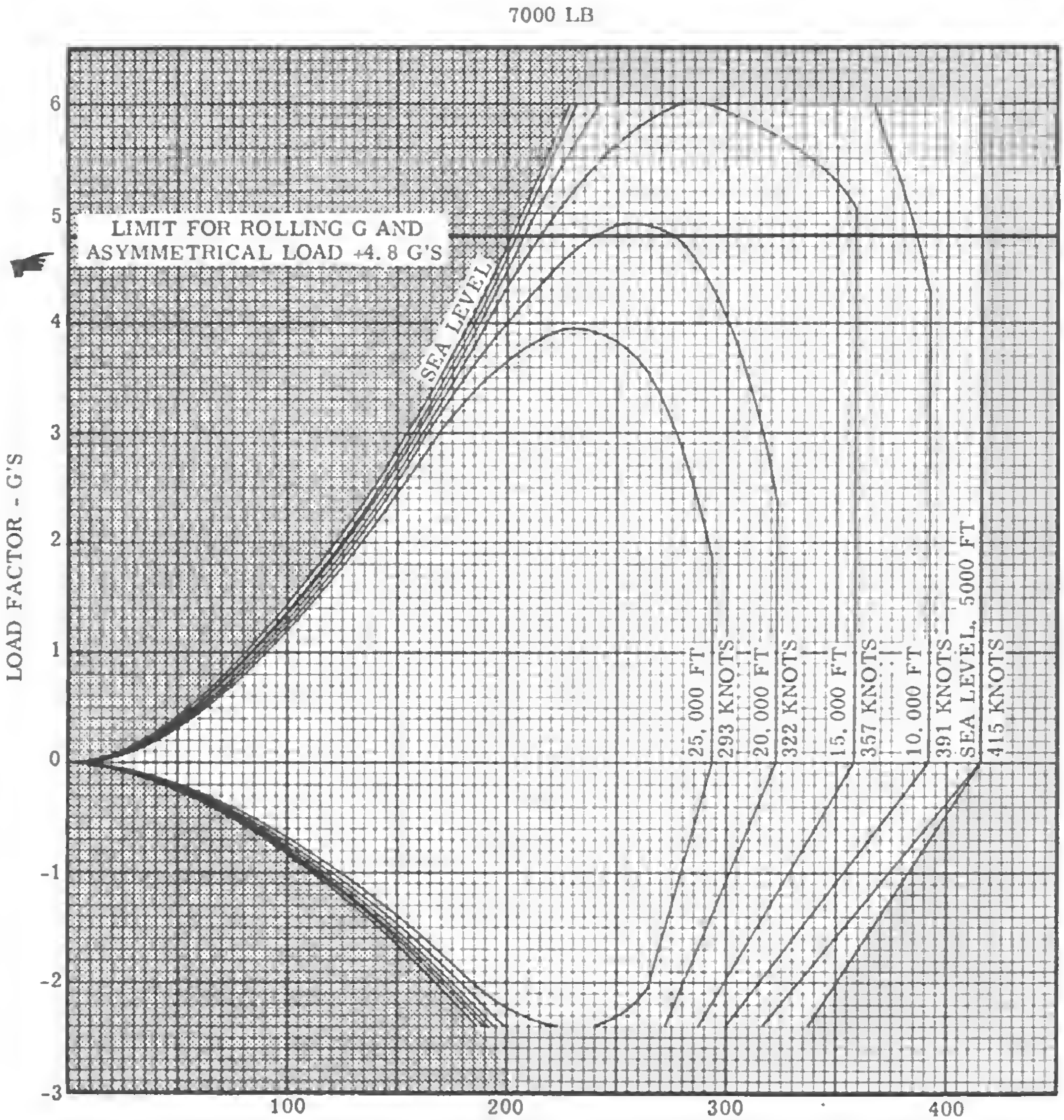
+4. 8 G maximum for Rolling G

-2. 4 G maximum

Figure 5-1 (Sheet 2 of 2)

OPERATING FLIGHT STRENGTH





HOW TO READ CHART

1. SELECT DESIRED AIRSPEED.
2. TRACE VERTICALLY TO FLIGHT ALTITUDE.
3. MOVE HORIZONTALLY LEFT TO MAX "G's" ALTITUDE BEFORE STALLING.

STALL

SAFE

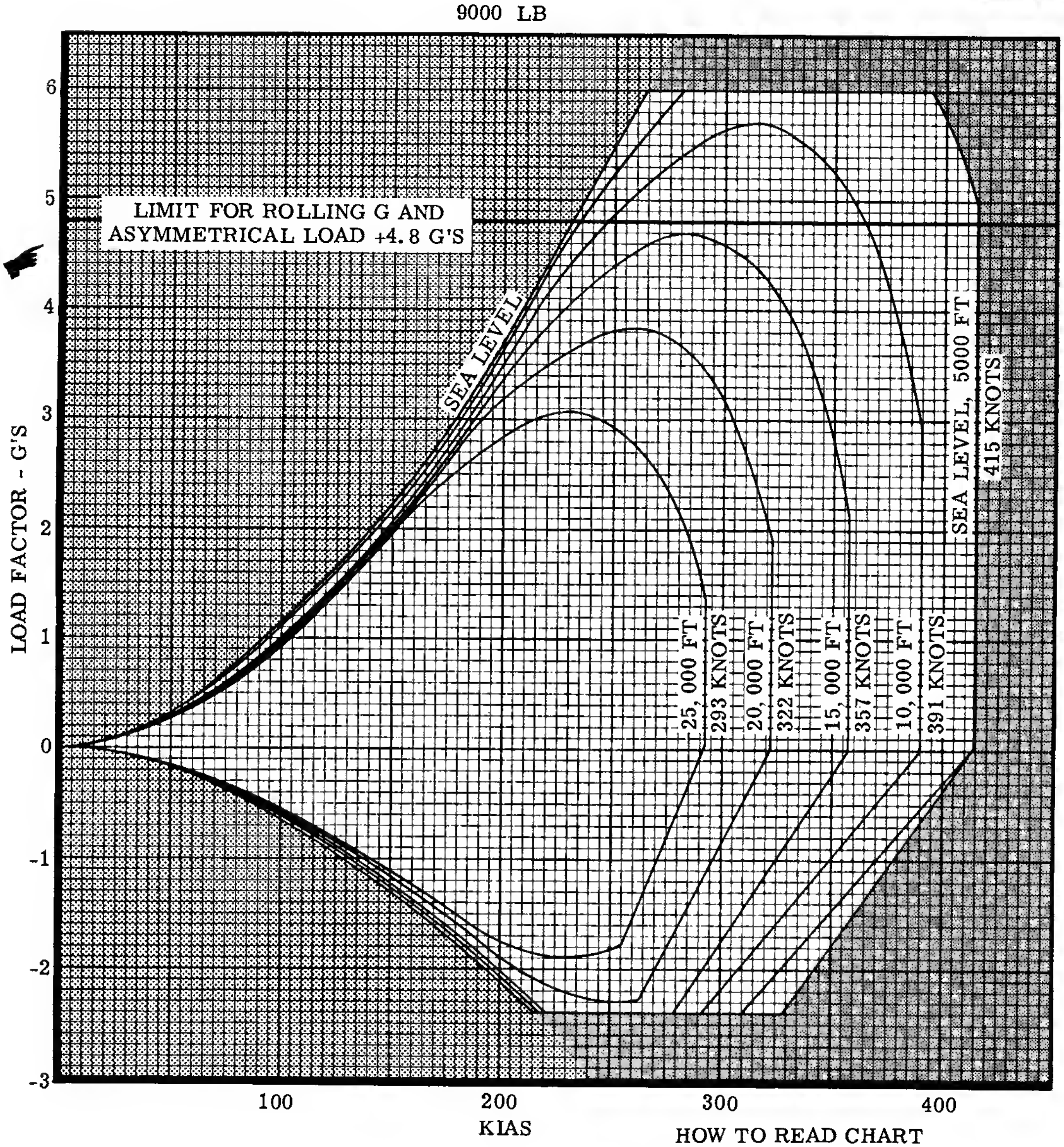
UNSAFE - STRUCTURAL LIMITS

NOTE:

THE LIMITING STRUCTURAL AIRSPEED IS 415 KIAS OR .70 INDICATED MACH NO. WHICHEVER OCCURS FIRST.

Figure 5-2 (Sheet 1 of 4)

OPERATING FLIGHT STRENGTH



HOW TO READ CHART

1. SELECT DESIRED AIRSPEED.
2. TRACE VERTICALLY TO FLIGHT ALTITUDE.
3. MOVE HORIZONTALLY LEFT TO MAX "G's" ALTITUDE BEFORE STALLING.

STALL

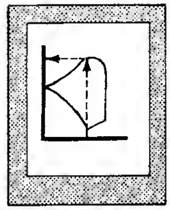
SAFE

UNSAFE - STRUCTURAL LIMITS

NOTE:

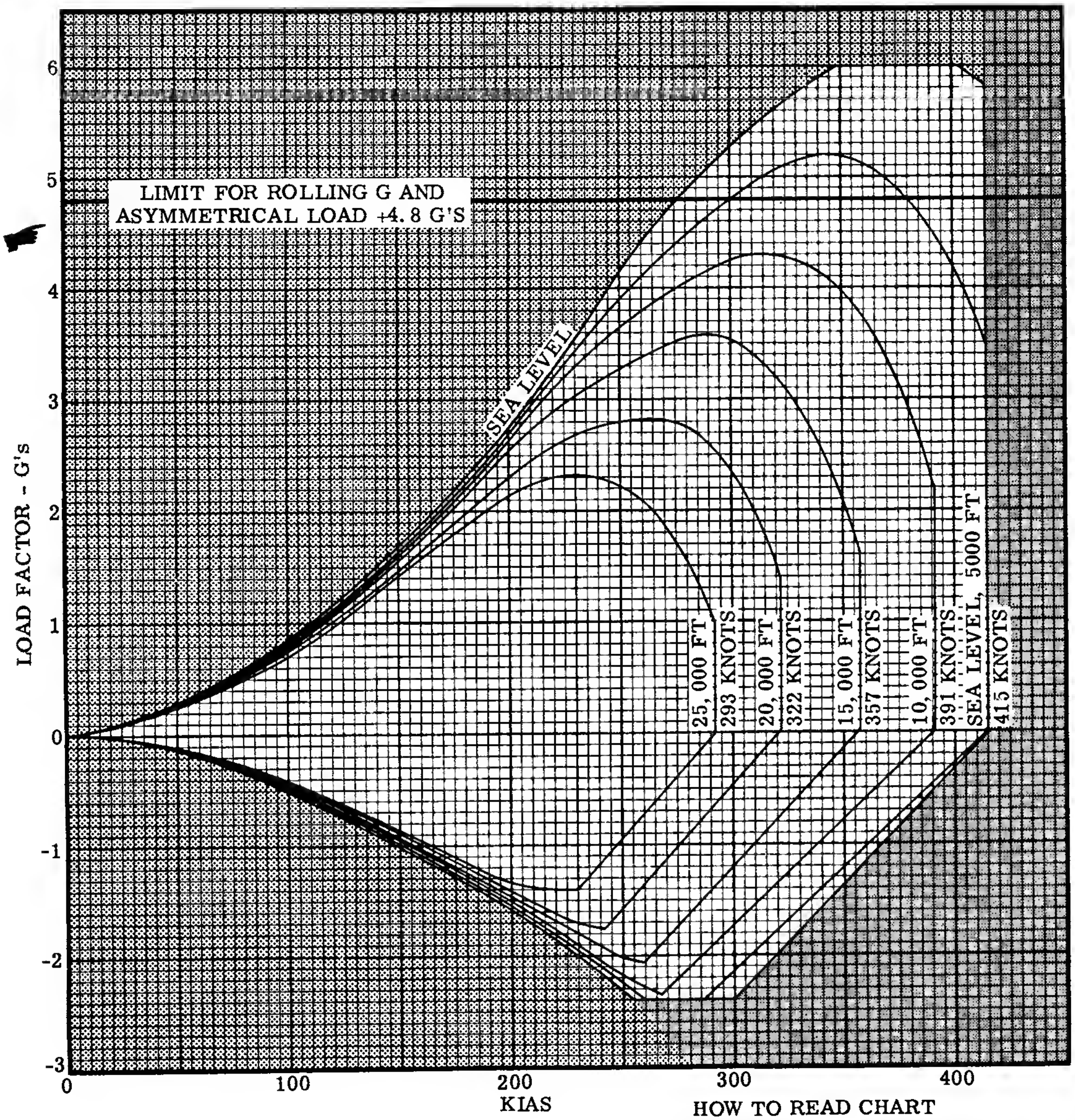
THE LIMITING STRUCTURAL AIRSPEED IS 415 KIAS OR .70 INDICATED MACH NO. WHICHEVER OCCURS FIRST.

Figure 5-2 (Sheet 2 of 4)



OPERATING FLIGHT STRENGTH

12,000 LB



HOW TO READ CHART

1. SELECT DESIRED AIRSPEED.
2. TRACE VERTICALLY TO FLIGHT ALTITUDE.
3. MOVE HORIZONTALLY LEFT TO MAX "G's" ALTITUDE BEFORE STALLING.

NOTE: THE LIMITING STRUCTURAL AIRSPEED IS 415 KIAS OR .70 INDICATED MACH NO. WHICHEVER OCCURS FIRST.

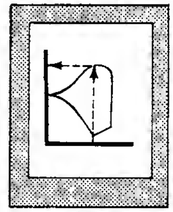
STALL

SAFE

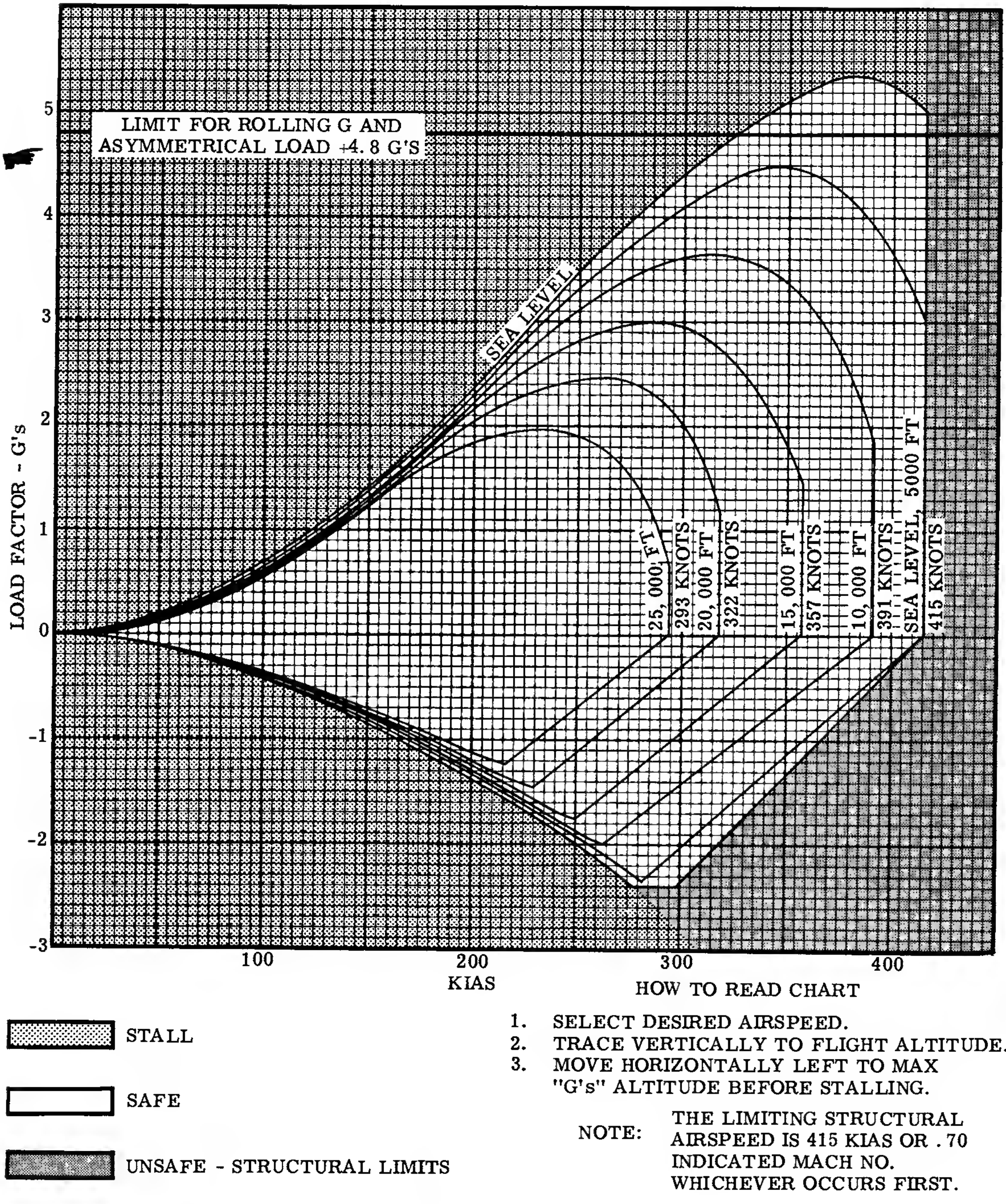
UNSAFE - STRUCTURAL LIMITS

Figure 5-2 (Sheet 3 of 4)

OPERATING FLIGHT STRENGTH



14,000 LB



HOW TO READ CHART

1. SELECT DESIRED AIRSPEED.
2. TRACE VERTICALLY TO FLIGHT ALTITUDE.
3. MOVE HORIZONTALLY LEFT TO MAX "G's" ALTITUDE BEFORE STALLING.

NOTE: THE LIMITING STRUCTURAL AIRSPEED IS 415 KIAS OR .70 INDICATED MACH NO. WHICHEVER OCCURS FIRST.

Figure 5-2 (Sheet 4 of 4)

PROHIBITED MANEUVERS

The following maneuvers are prohibited:

1. Vertical whip stalls.
2. Snap rolls.
3. Intentional fish tail type maneuver by repeated rudder reversal.
4. Maneuvers performed by trim alone.
5. Trimming in a dive at a speed within 20 knots of the limiting structural sirspeed.
6. Negative G's for more than 10 seconds.
7. Intentional spins.

Note

Any maneuver resulting in prolonged negative acceleration will result in engine flame-out. There is no means of insuring a continuous flow of fuel for more than 10 seconds in this attitude.

CENTER OF GRAVITY LIMITATIONS

The aircraft is always loaded so that any expenditure of load or shift in crew members will result in a center of gravity which is always within satisfactory limits. Refer to T. O. 1A-37A-5 for the current applicable operation restrictions.

Note

The forward center of gravity limit may be exceeded by improper fuel management. This condition exists when loaded to gross weight with full internal and tip tank fuel. If the pilot fails to switch to tip tank fuel after takeoff and expends all of the internal fuel before releaseing any of the droppable stores the forward c. g. limit may be exceeded.

▲ AIRCRAFT 67-14776 THRU 69-6434 EXCEPT MODIFIED PER T.O. 1A-37B-521.

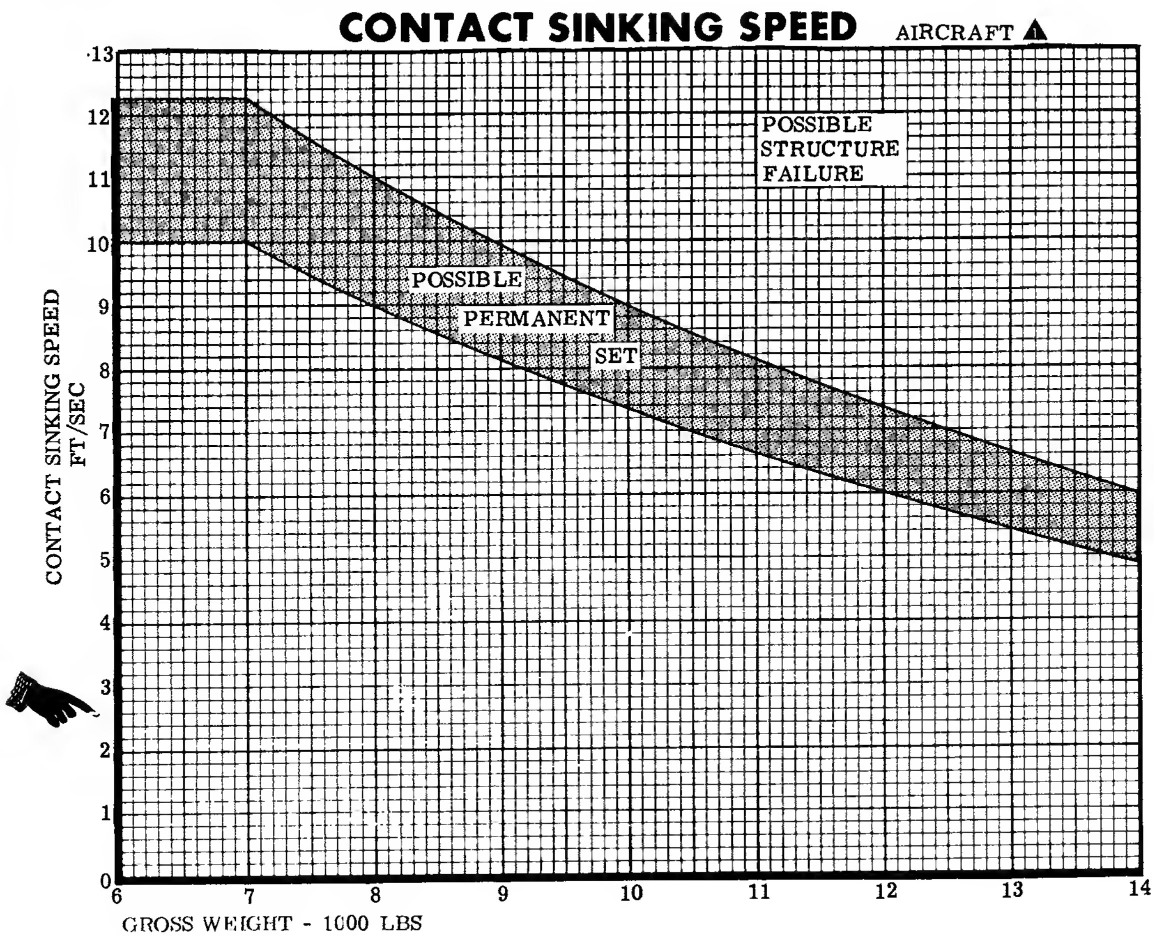


Figure 5-3

WEIGHT LIMITATIONS ⚠1

1. Maximum gross weight should not exceed 14, 000 pounds.
 a. Do not exceed 4. 8 feet per second when landing at 14, 000 pounds.
2. Restrictions for gross weights above 12, 000 pounds.
 a. Use extreme caution when taxiing and braking to avoid abrupt turns and sudden or heavy braking.

WEIGHT LIMITATIONS ⚠2

1. Maximum gross weight should not exceed 14,000 pounds.
 a. Do not exceed 6. 0 feet per second when landing at 14,000 pounds.

EXTERNAL STORES LIMITATIONS

1. Do not exceed plus 4. 8 G's with asymmetrical stores loading.
2. Use a wing to wing dropping sequence to minimize asymmetrical loading.

Figure 5-5 lists all the authorized stores and their pylon locations. The stores release and structural limits are shown in figure 5-4.

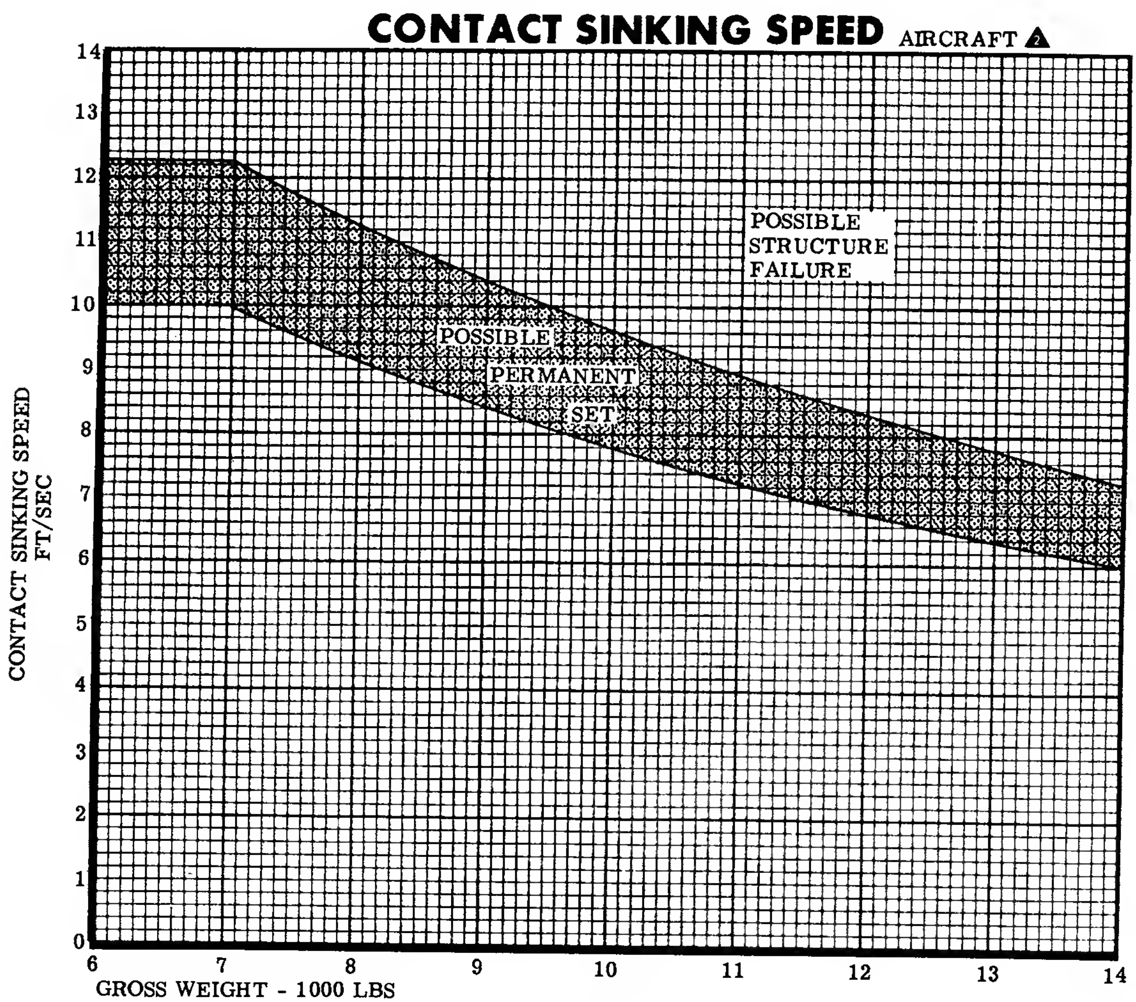


Figure 5-3A

⚠1 AIRCRAFT 67-14776 THRU 69-6434 EXCEPT MODIFIED PER T.O. 1A-37B-521.

⚠2 AIRCRAFT 69-6435 AND ON AND AIRCRAFT 67-14776 THRU 69-6434 WHEN MODIFIED PER T.O. 1A-37B-521.

EXTERNAL STORES

STORE		LIMITATION KIAS –MAX.	RECM KIAS
AN-M47A4		350	
AF/B-37K-1 [4]	BOMBS BDU-33/B, BDU-33A/B AND BDU-33B/B	320	320
BLU-1C/B BLU-23/B BLU-27/B BLU-27A/B BLU-32/B BLU-32A/B(UNFINNED) BLU-52/B (UNFINNED)	[8] [19] [16] [8] [19] [8] [19] [16] [16] [16] [17]	350 [11] 300 350 [11] 350 [11] 300 300 320	 270
CBU-14/A [7] CBU-14A/A [7]	DISPENSE LOADED EMPTY	350 200 200 [9]	 160 160
CBU-52/B [2] [20] CBU-52A/B [2] [20]		350 [11] 350 [11]	
CBU-22/A [7] CBU-22A/A [7]	DISPENSE LOADED EMPTY	350 200 200 [9]	 160 160
CBU-24A/B [2] [20] CBU-24B/B [2] [20]		350 [11] 350 [11]	
CBU-25/A [7] CBU-25A/A [7]	DISPENSE LOADED EMPTY	350 200 200 [9]	 160 160
CBU-29A/B [2] [20] CBU-29B/B [2] [20]		350 [11] 350 [11]	
CBU-49A/B [2] [20] CBU-49B/B [2] [20]		350 [11] 350 [11]	
CBU-53/B [2] [20] CBU-54/B [2] [20]		350 [11] 350 [11]	

[1] No flight qualification to date.

[2] Do not carry on #2 pylon adjacent to pylon tank or BLU-52/B on #1 pylon. When loaded on #2 pylon adjacent to a BLU-1C/B, BLU-27/B or BLU-27A/B on #1 pylon, release the store from #1 pylon first.

[3] Not to be dropped at less than 1 "G" flight or dive angles greater than 30°

[4] Jettison dispenser or pod in emergency only.

[5] Arming wire must extend 20" aft of the fin.

[6] 200 KIAS maximum when adjacent to pylon tank, BLU-1C/B, BLU-27/B or BLU-27A/B.

[7] Sway brace pads must be reversed for carriage.

[8] Do not release above 300 KIAS when carried on #2 pylon adjacent to pylon tank, BLU-1C/B, BLU-27/B or BLU-27A/B. If carried on both #1 and #2 pylons, drop #1 pylon first.

[9] 160 KIAS maximum when adjacent to pylon tank, BLU-1C/B, BLU-27/B or BLU-27A/B.

[10] A maximum of two rocket launchers may be fired simultaneously if they are loaded symmetrically (one on the left wing and one on the right on equivalent stations). All other multiple rocket launcher firings are prohibited due to structural limitations. Rocket launchers may be fired one at a time from any station authorized for flight.

[11] Minimum release 200 KIAS.

[12] 120 KIAS when adjacent to pylon tank, BLU-1C/B, BLU-27/B or BLU-27A/B.

Figure 5-4 (Sheet 1 of 2)

RELEASE LIMITS

STORE		LIMITATION KIAS – MAX.	RECM KIAS
LAU-3/A [10]	DISPENSE LOADED EMPTY	350 300 [9] 200	 160 [12] 160
LAU-32A/A [10] LAU-32B/A [10]	DISPENSE LOADED EMPTY	350 300 [6] 200 [13]	 160 [12] 160
LAU-54/A [10] LAU-59/A [10]	DISPENSE LOADED EMPTY	350 300 [6] 200 [13]	 160 [12] 160
M117 [2] [18] [20] M117A1 [2] [18] [20] M117A1E2 [2] [18] [20] M117A1E3 [2] [18] [20]		350 [11] 350 [11] 350 [11] 350 [11]	
MK-36 [3] [5] [15]		350	
MK-81		350	
MK-82 [2] MK-82/M1A1 FUZE EXTENDER [2] [22] MK-82 (SNAKEYE 1)	[3] [5] [15]	300 300 350	
PYLON TANKS [20]	FULL EMPTY	300 250 [11]	160 220
SUU-11A/A [4]		350 (FIRING SPEED)	
CBU-55/B		300	
M129E1 [21]		225	
SUU-25A/A [20]	DISPENSE [14] LOADED EMPTY	350 (MIN 300) 300 300	

[13] No flight qualification to date when adjacent to pylon tank, BLU-1C/B, BLU-27/B or BLU-27A/B.

[14] Not to be dispensed during decelerating flight.

[15] After release execute a 4 "G" 100% power pullup or 4 "G" banked turn escape maneuver.

[16] Do not release at less than 1 "G" flight.

[17] Do not carry stores adjacent to a BLU-52/B, unless such stores will be released prior to releasing the BLU-52/B.

[18] The M117 with MAU-103A/B fins have identical flight limitations to the M117 or M117A1 with M131 fins. The MAU-103/B fin is not qualified on this aircraft.

[19] This store does not meet minimum ground clearance criteria. Operations from unimproved air strips or landings on any surface with this store are not recommended.

[20] This store does not meet minimum ground clearance criteria and may contact the ground under conditions of flat tire and/or deflated landing gear strut.

[21] Carriage limitations are -1 G to +4.8 G (-0.8 G to +3.8 G asymmetric). Release limitations are +0.9 G to +1.1 G. Release at a zero degree dive angle in either single or pairs mode.

[22] Carriage limitations are -1.2 G to +4.8 G. Release limitations are +0.7 G to +1.2 G. Release at a maximum dive angle of 45° in either single or pairs mode.

Figure 5-4 (Sheet 2 of 2)

AUTHORIZED STORES LOCATION

STORE	TYPE	STORES LOCATION			
		L1, R1 (INBOARD)	L2, R2 (INBOARD INTERMEDIATE)	L3, R3 (OUTBOARD INTERMEDIATE)	L4, R4 (OUTBOARD)
AN-M47A4	PWP, WP BOMB	X	X	X	X
AF/B-37K-1	PRACTICE BOMB CONTAINER RACK (WITH BDU-33/B, BDU-33A/B AND BDU-33B/B)	X	X	X	X
BLU-1C/B	FIRE BOMB	X	X		
BLU-23/B	FIRE BOMB	X	X	X	
BLU-27/B BLU-27A/B	FIRE BOMB	X	X		
BLU-32/B BLU-32A/B	FIRE BOMB	X	X	X	
BLU-52/B	CHEMICAL BOMB	X	X	X	X
CBU-14/A CBU-14A/A	DISPENSER & BOMBS	X	X	X	X
CBU-22/A CBU-22A/A	DISPENSER & BOMBS	X	X	X	X
CBU-24A/B CBU-24B/B	DISPENSER & BOMBS	X	X		
CBU-25/A CBU-25A/A	DISPENSER & BOMBS	X	X	X	X
CBU-29A/B CBU-29B/B CBU-49A/B CBU-49B/B CBU-53/B CBU-54/B	DISPENSER & BOMBS	X	X		
CBU-52/B CBU-52A/B	DISPENSER & BOMBS	X	X		
CBU-55/B	FAE BOMB CLUSTER				
LAU-3/A	ROCKET LAUNCHER	X	X	X	
LAU-32A/A LAU-32B/A LAU-54/A LAU-59/A	ROCKET LAUNCHER	X	X	X	X
M117 M117A1 M117A1E2 M117A1E3	GP BOMB	X	X		
M129E1	LEAFLET BOMBS	X		X	
MK-36	DESTRUCTOR	X	X	X	
MK-81	GP BOMB	X	X	X	X
MK-82	GP BOMB	X	X	X	
MK-82/M1A1	GP BOMB & FUZE EXTENDER	X	X	X	
MK-82 (SNAKEYE 1)	GP BOMB	X	X	X	
PYLON TANK	FUEL-100 GAL	X	X		
SUU-11A/A	GUN POD	X	X	X	X
SUU-25A/A	FLARE DISPENSER	X	X	X	X

Note

Authorized stores locations for the CBU-55/B Fuel Air Explosive Bomb Cluster have not been established.

Figure 5-5

SECTION VI

FLIGHT CHARACTERISTICS

TABLE OF CONTENTS

FLIGHT CHARACTERISTICS

Engine Roll Back

With a throttle in the idle position, flight at airspeeds below 150 KIAS may result in a decrease (roll-back) of flight idle rpm to approximately 30% rpm at altitudes above 15,000 feet. It may require as long as 3 minutes to accelerate the engine to 100% rpm from this rolled back condition unless the nose is lowered to increase airspeed above 180 KIAS. Refer to figure 6-4 for idle rpm vs altitude chart.

Engine Compressor Stalls

During high G maneuvers between 120-250 KIAS at or above 90% rpm, engine compressor stalls on either or both engines should be anticipated when the aircraft is near or in the high speed prestall buffet condition. In isolated instances, these compressor stalls have terminated in a flameout. The probability of such compressor stalls is increased by the use of speed brakes in the maneuvers. The left engine usually stalls first. When a compressor stall occurs, immediately retard the throttle(s) to the idle stop and readvance normally. This procedure should break the compressor stall if the engine has not flamed out. In the event of a flameout, the normal airstart procedures should be used.

STALLS

Clean configuration stalls will be preceded by heavy buffeting occurring about four knots above the stalling speed. On accelerated stall entries, stall warning occurs approximately eight knots above stalling speeds. Power settings influence the stall warning airspeed but not the stall characteristics of the aircraft. When no artificial stall warning device is used, there is no stall warning in the power approach configuration. Lateral control throughout the stall maneuvers is good, and no uncontrollable rolling tendencies occur; however, holding the control stick full back will cause pitch oscillation of the aircraft. Elevator control is very good throughout the stall. A rapid forward movement on the control stick will cause the aircraft to pitch sharply which is followed by immediate recovery. Lowering the flaps decreases the stall speed markedly, but heavy buffeting still occurs well above the stalling speed. Aileron and elevator control remains good in a flap-down stall, and good recovery is easily obtained. Stalls with gear and flaps extended usually result in a roll-off to the left or right. This roll is easily controlled by prompt application of aileron control. The stall speed decreases by approximately 8 KIAS for any loading, as the power of both engines is increased from idle to 100% power. Therefore, it is possible to fly the aircraft out of power off stalls by adding power; however, caution should be exercised to insure that both engines accelerate together as power is added.

SPINS

WARNING

Spins have not been structurally qualified in the A-37 aircraft; therefore, intentional spins are prohibited.

A qualitative spin flight program has been conducted in the A-37B aircraft. Spins have been performed under the following conditions and configurations:

1. With or without the external refueling equipment installed.
2. With no fuel in the tip tanks.
3. With no external stores or with two empty pylon tanks installed symmetrically on stations 1 or 2, or with four empty pylon tanks on stations 1 and 2.
4. Internal wing fuel must be monitored with a maximum allowable differential of 70 pounds.
5. The gear and flaps should be up and the speed brakes and inlet screens retracted.

SPIN CHARACTERISTICS

Based on flight test spin programs on T-37 series aircraft and A-37 aircraft the following background information is provided which is applicable to the A-37 aircraft.

The A-37 has three spin modes: erect normal, erect accelerated and inverted. The primary characteristics of each mode are well defined. However, minor characteristics will vary depending on the fuel remaining, external load, type of entry, etc. Although these variations appear minor, they have a definite effect on recovery and, also, on the pilot's ability to recognize what kind of spin exists.

NORMAL SPINS

The A-37 will spin in either direction, from 1.0G stall approach or from accelerated entry conditions by applying full back stick and full rudder in the direction of the desired spin.

The entry will vary depending on the pitch attitude at the time of stall, the type of entry (0.0G, 1.0G or accelerated), the sequence of pro-spin control inputs, the aircraft gross weight, and the external load configuration.

The altitude lost during the first few turns will vary from zero to 1000 feet. The time per turn for the first few turns is slow (over ten seconds) for the 1.0G entries at higher gross weights compared to the very rapid (less than three seconds) for the accelerated entry with four empty pylon tanks installed. The first turn is more like a roll, with subsequent turns displacing more of the characteristic yawing motion. The 0.0G inverted and 1.0G erect entries are the least oscillatory. The installation of the refueling probe and additional external stores causes some lateral oscillations. It is also possible to induce lateral oscillations by applying the pro-spin rudder prior to pulling the stick aft. During the first few turns the aircraft nose may come back above the horizon, however by the end of the third turn, a stabilized nose-low spin will develop. The spin entry is not considered violent.

Once the aircraft has entered a stabilized spin the altitude loss is approximately 700 feet per turn, completing a full turn in about 3 seconds. The pitch attitude during this erect normal mode is approximately 40 degrees below the horizon. The indicated airspeed during the spin oscillates between 20 and 60 KIAS with an average of 50 KIAS. Failure to retard the throttles to idle will increase the altitude lost per turn, cause the nose to be slightly lower in the stabilized spin, make the control forces somewhat higher, and possibly produce dual engine flameouts. Engine operation at idle while in a spin will be approximately 43 to 48% rpm with approximately 400°C EGT.

ACCELERATED SPINS

The accelerated spin is caused by placing the elevator control in some position other than full back stick. As the stick is eased forward, the aircraft will progress into a more nose low attitude, the time per turn will decrease. The magnitude of these changes depends upon the amount of forward stick used. The highest rotation rate is encountered with the stick full forward and the rudder opposite to the direction of rotation. The stick full forward maneuver is difficult to perform as the controls must be moved abnormally slow, requiring a minimum of four seconds to full deflection. If controls are moved too fast, the aircraft will recover. The indicated airspeed will stay between 20 and 60 KIAS. As the spin progresses from normal to the accelerated condition, lateral accelerations will be felt and the aircraft will whip as the rate of rotation increases. A new stabilized rotation rate is reached shortly after the stick movement is stopped and the accelerated control position is established. The application of aft stick will immediately bring the aircraft back into the erect normal mode.

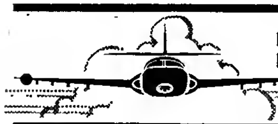
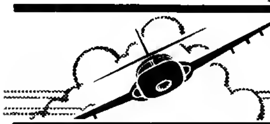
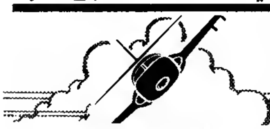
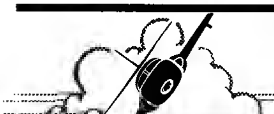
INVERTED SPINS

The inverted spin can be entered by raising the aircraft nose to a 30° to 40° pitch attitude, rolling inverted, pushing full forward stick and when light buffet is encountered, apply full rudder in the direction of desire rotation. It is also possible to enter an

STALL SPEED CHART . . . . KIAS

*** POWER OFF**

DATE: 15 JANUARY 1968
DATA BASIS: ESTIMATED

GROSS WEIGHT	6000 LBS			9000 LBS			12,000 LBS			14,000 LBS		
FLAP POSITION	UP	HALF	FULL	UP	HALF	FULL	UP	HALF	FULL	UP	HALF	FULL
 LEVEL FLIGHT	83	75	70	102	91	85	118	105	99	127	114	106
 30° BANK	89	80	75	110	98	92	127	113	106	137	122	114
 45° BANK	99	89	83	121	109	102	140	125	117	151	135	127
 60° BANK	118	105	99	144	129	121	167	149	139	180	161	151

* FOR POWER-ON Stall Speeds, (Approx. 85%) Subtract 3 Knots.

Figure 6-1

inverted spin from an erect spin by using improper recovery technique. The first turn will be slow and smooth and will appear to be a roll. An inverted spin is difficult to enter from this inverted 0.0G maneuver when the aircraft gross weight is light. In this case the aircraft will enter a negative G inverted spiral with increasing airspeed and increasing negative G. In a stabilized inverted spin the indicated airspeed will be between 125 and 140 KIAS with a stabilized load factor between -1.2 and -1.8 G's. The altitude lost per turn is approximately 800 feet. It is anticipated that, as the gross weight increases, the spin rate will be slower and the altitude lost per turn will be greater. During the inverted spins, the engine rpm may drift to below 40% and both generators drop off the line. In addition, the ENGINE ICE and FUEL LOW lights may come on during this spin mode. The inverted spin can be accelerated by allowing the controls to free float or by holding rudder in the direction of rotation and moving the stick aft. As with the erect accelerated spin, the nose drops and rotation rate increases until a new stabilized rate is reached.

SPIN RECOVERY

One procedure should recover the aircraft from any spin under all conditions. In case of inadvertent spin entry proceed as follows:

1. THROTTLES - IDLE.

WARNING

If throttles are not retarded to idle, dual engine flameout may occur. A normal spin recovery may still be made.

2. EXTERNAL STORES - JETTISON.
3. RUDDER AND AILERONS - NEUTRAL.
4. STICK - ABRUPTLY MOVE FULL AFT AND HOLD.
   a. If the spin is inverted, a rapid and positive recovery will be affected within one-half turn.
   b. If the spinning stops, neutralize controls and recover from the ensuing dive. If the spinning continues, the aircraft must be in an erect normal spin (it cannot spin inverted or accelerated with the controls held in this position). Determine the direction of rotation and proceed with the following steps:
5. RUDDER - ABRUPTLY APPLY FULL RUDDER OPPOSITE TO THE DIRECTION OF SPIN AND HOLD.
6. STICK - ONE TURN AFTER APPLYING RUDDER, ABRUPTLY MOVE THE STICK FULL FORWARD.
   a. As the nose pitches down, relax forward pressure while continuing to hold rudder until spinning has stopped. Do not allow the stick to move aft of neutral until recovery is effected.
   b. Recovery should be accomplished within two turns from the point at which recovery rudder was applied.

WARNING

One of the major reasons for missing a recovery is not waiting long enough after the recovery controls have been initiated.

Note

If forward stick is applied before rudder effectiveness is obtained, the spin will momentarily speed up and recovery will take slightly longer.

7. CONTROLS - NEUTRAL AFTER SPINNING STOPS AND RECOVER FROM ENSUING DIVE.

WARNING

The characteristics of the spin and the effectiveness of recovery procedure will vary: (1) If the stick is not held full aft with rudder neutral during the spin; (2) If the aircraft is spun with over 70 pounds asymmetric wing fuel; (3) If the application of recovery controls is not executed briskly; (4) If the recovery procedure is varied so that less than full rudder or full-down elevator is obtained; (5) If forward stick is applied before rudder effectiveness is obtained.

CAUTION

If a landing configuration spin is entered inadvertently, both gear and flaps should be retracted as soon as possible after recovery to prevent excessive structural loads.

8. EJECT NO LOWER THAN 10,000 FEET AGL unless rotation has stopped and recovery is assured.

Note

It is not necessary to relax the forward pressure after the nose pitches down in order to effect recovery; however, if the stick is held forward, the aircraft attitude upon recovery can be past the vertical. In this position, the aircraft will transition into an inverted spin unless controls are neutralized immediately.

inverted spin from an erect spin by using improper recovery technique. The first turn will be slow and smooth and will appear to be a roll. An inverted spin is difficult to enter from this inverted 0. 0G maneuver when the aircraft gross weight is light. In this case the aircraft will enter a negative G inverted spiral with increasing airspeed and increasing negative G. In a stabilized inverted spin the indicated airspeed will be between 125 and 140 KIAS with a stabilized load factor between -1. 2 and 1. 8 G's. The altitude lost per turn is approximately 800 feet. It is anticipated that, as the gross weight increases, the spin rate will be slower and the altitude lost per turn will be greater. During the inverted spins, the engine rpm may drift to below 40% and both generators drop off the line. In addition, the ENGINE ICE and FUEL LOW lights may come on during this spin mode. The inverted spin can be accelerated by allowing the controls to free float or by holding rudder in the direction of rotation and moving the stick aft. As with the erect accelerated spin, the nose drops and rotation rate increases until a new stabilized rate is reached.

SPIN RECOVERY

Refer to Section III for spin recovery procedures and characteristics.

FLIGHT CONTROLS

PRIMARY CONTROLS

The primary flight controls (ailerons, elevators, and rudder) are very effective with a symmetrical load. The ailerons will remain effective throughout the speed range from limiting speed to stall speed. The

use of ailerons does not result in noticeable adverse or favorable yaw throughout the airspeed range of the aircraft. The elevators provide adequate pitch control to maneuver to the limiting load condition in the useful speed range. Directional control (rudder and ailerons combined) is ample to hold an on-course heading down to stall with only one engine operating. Due to the lack of dihedral (roll due to yaw) effect, it is not possible to pick-up a low wing with rudder.

CONTROL TRIM TABS

The control surface trim tabs will effectively reduce the control forces to zero for the useful flight range and operating extremes of the aircraft with a symmetrical load and both engines operating. Caution should be exercised in trimming the aircraft in high-dive speeds. See Section V, Operating Limitations. Out-of-trim stick forces caused by operation of the flaps, landing gear and speed brake are controllable throughout the operating speed range. Refer to Section III for runaway trim procedures.

Note

- Aileron trim position should be check frequently throughout flight and after landing. Requirements of more than ½ aileron trim with symmetric external load indicate a wing heavy condition due to trapped fuel in the internal wing tanks. If trapped fuel is suspected, proceed as outlined under FUEL UNBALANCE, Section II.

- Rudder trim position should be checked on preflight and after landing. Use of more than ½ rudder trim under symmetrical load conditions may indicate an out of rig condition.

- Single engine operation may require more rudder trim than is available. Under this condition, directional control may be maintained by use of aileron trim to maintain a slight sideslip or by holding additional rudder force.

POWER AFFECTS

Because the engine thrust line is located below the aircraft center of gravity, a nose up trim change can be expected as throttle is advanced. This nose up trim change will require approximately 15 pounds of forward stick force as power is increased from idle to 100%, and can be relieved with the application of forward trim. The opposite situation can be anticipated as power is reduced from 100% power to idle.

MANEUVERING FLIGHT CHARACTERISTICS

Variable Bob Weight

A variable bob weight has been incorporated on the A-37 aircraft to achieve an acceptable level of stability when operating with an aft center of gravity as well as acceptable stick force per G gradient when operating with a forward center of gravity. This is necessary due to the wide variety of stores that can be carried on the aircraft and the effect these stores have on the aircraft center of gravity and aerodynamic center.

The bob weight, located forward of the right-hand stick well, is normally set and safetied depending on the stores loaded on the aircraft. Once properly set for a particular store loading prior to flight, the bob weight will provide acceptable stick forces and acceptable longitudinal stability both before and after any or all stores are expended. Therefore, it is not necessary for the pilot to make adjustments to the bob weight in-flight.

Maneuverability

Maneuvering stick force gradients are essentially linear with G or for particular store loading and remain relatively constant with altitude until approaching the limiting Mach number of the aircraft. However, the stick force per G-gradient for a forward CG loading will be appreciably higher than for an aft CG loading. Therefore, the stick force required to effect recovery from a stores delivery run can be expected to change in-flight as fuel is used and stores are expended. Caution must be exercised to prevent overstressing the aircraft when making a recovery after delivering certain forward CG stores, such as M117 series bombs.

Rolls

The aileron system was designed to produce adequate roll rates throughout the speed range for a clean aircraft without stores. Due to the fixed aileron size and available deflection, a noticeable deterioration in roll rate and acceleration occurs as wing stores are added. This deterioration is most noticeable at low airspeeds and the landing and takeoff configurations. Pilots must anticipate this reduced roll authority when landing and taking off with wing stores in conditions of crosswind, wake turbulence, and gusts. Aircraft ▲ have slot lip spoilers located forward of the leading edge of the flaps. These spoilers provide a marked increase in roll rates at all gross weights and airspeeds. Also, due to the manual control system, the stick force required to accomplish rolling maneuvers is increased as the number of wing stores is increased. This stick force increase is most noticeable at high indicated airspeeds, such as would be encountered in weapons delivery patterns.

Some deterioration of the aileron effectiveness is due to the interference drag and airflow associated with

▲ AIRCRAFT 68-7975 AND ON AND AIRCRAFT 67-14776 THRU 68-7974 WHEN MODIFIED PER T. O. 1A-37B-530.

stores carried on the outboard stations (L2 - R2, L3 - R3, and L4 - R4). Therefore, whenever the requirements of the mission permit, expend stores starting at outboard stations and progress inboard.

DIVING

The aircraft performs well in high speed dives and letdowns. A slight decrease in directional stability may occur at high speeds and high altitudes in dives with the speed brake extended, and will be noticeable to the pilot by the "hunting" motion of the nose.

The limit Mach number is .70 at low load factors, and it decreases as "G's" are pulled. Above this Mach number the aircraft tends to tuck under, the dive angle increases and considerable back pressure is required to prevent the dive angle from increasing. Because forward speed must decrease before recovery from this type of dive can be accomplished, a large loss in altitude results. The aircraft will also experience heavy buffeting at high speeds above the critical Mach number.

CAUTION

The critical Mach number can be easily exceeded when the aircraft is deliberately dived at very steep angles. Never allow the aircraft speed to exceed that indicated by the maximum allowable airspeed pointer which marks limit Mach number.

If critical speed is exceeded it can be detected by:

1. A rapid change in trim which requires considerable back pressure to keep the dive angle from increasing.
2. Buffeting of the aircraft and controls.

When steps one and two occur the recovery procedure is as follows:

1. Maintain stick force to keep aircraft from increasing dive angle.
2. Throttles - IDLE.
3. Speed brake switch - OUT.

As altitude is lost and speed decreases below critical, a normal pullout may be executed.

Care should be taken not to dive at steep angles for prolonged periods without monitoring airspeed and executing pullout if critical speed is approached. For a more complete breakdown on the effect of a normal acceleration on critical speed, see figure 5-2.

WARNING

If you are lower than 10, 000 feet above the terrain before buffeting stops and pullout begins - EJECT.

SPEED BRAKE AND THRUST ATTENUATORS

The speed brake is used to increase the aircraft drag for recovery from a high speed dive, to improve descent rate from altitude, and to increase the approach angle during landing. The speed brake is designed to give a minimum pitching moment change and only a small amount of nose up trim is necessary on brake extension. Extension of the speed brake causes a noticeable buffet which decreases in intensity as airspeed is reduced.

The thrust attenuators are designed to reduce the effective thrust of the engine and serve the same purpose as the speed brake. Extension of the attenuators causes no noticeable pitch change. They enable the pilot to maintain a higher engine rpm on landing in order that faster accelerations will be available for go-around situations without flattening the approach angle. Both the speed brake and the attenuators may be safely extended at any speed within the useful range of operation. Since the speed brake and the thrust attenuators are intended to supplement each other, actuation is simultaneous by the same control switch.

EFFECT OF ASYMMETRIC THRUST

SINGLE ENGINE OPERATION

In general the A-37 can be flown on one engine throughout the flight envelope. Under certain conditions of gross weight and altitude, loiter and cruise can be accomplished on single engine at a saving of fuel or with an increase of range as compared with dual engine operation.

The directional and lateral trim required for single engine operations will be different for each thrust setting selected on the operating engine. At high power settings, insufficient rudder trim may be available and control forces must be held by the pilot or uncoordinated flight will result.

When operating with left engine shutdown, the engine ice light may flicker on and off due to the interrupted airflow around the engine ice detector located in the left engine inlet.

EFFECT OF ASYMMETRIC LOADING

Note

This discussion is restricted to flight with one asymmetric store. Flight with more than one asymmetric store is not recommended. Refer to figure 6-3 for minimum aileron control and aileron trim control speeds for asymmetrical loading.

FLIGHT WITH ASYMMETRIC LOAD

Deterioration of available aircraft control due to asymmetric loading may be broken down into two areas. First is the unbalance moment or torque effect, which acts about the aircraft roll axis and which is due to the weight of the asymmetric load times its effective lever arm left or right of the aircraft CG. This unbalance moment must be counteracted by the application of aileron to produce a moment in the opposite direction to prevent continuous rolling in the direction of the heavy wing. As G forces are increased, the weight of the asymmetric store is, in effect, increased, thereby increasing the rolling moment, which in turn must be counteracted by the addition of more aileron.

The second area of deterioration is due to the unbalance drag effect of the asymmetric store about the aircraft's yaw axis. This yaw effect must be counteracted by the application of rudder.

TRIM EFFECTS WITH ASYMMETRIC STORES

Flight with asymmetric stores imposes a requirement for aileron and rudder trim or for pilot held control forces if coordinated flight is to be maintained. The amount of lateral and directional trim required changes continuously as airspeed changes.

As airspeed is decreased, an increasing amount of aileron trim is required until a speed may be reached at which full aileron trim is used. Further reduction in airspeed will require the pilot to hold lateral stick force to maintain wings level flight. Full aileron trim application results in approximately ½ available aileron deflection.

MINIMUM CONTROL SPEED WITH ASYMMETRIC LOADING

As airspeed is decreased below the minimum trim speed, an increasing amount of aileron deflection must be held by the pilot. Eventually, a speed will be reached at which full aileron deflection has been applied. This speed is defined as the Minimum Aileron Control Speed. A further decrease in airspeed below the minimum control speed will result in an uncontrollable roll in the direction of the heavy wing. The minimum control speed may or may not be above the stall speed of the aircraft for a given gross weight (see figure 6-3).

WARNING

Minimum control speeds shown in figure 6-3 were determined for one G flight and do not include any allowance for gusts, crosswind, wake turbulence, or G loads imposed by longitudinal maneuvering.

FLIGHT CHARACTERISTICS WITH ASYMMETRIC LOADS

Takeoff

Due to the limited aileron effectiveness of the A-37 at low airspeed, takeoffs with an unbalanced moment of more than 50, 000 inch-pounds (see figure 6-3) is not recommended. For all asymmetric takeoffs, normal nosewheel lift off and takeoff speeds should be increased 10 knots and the aircraft should be permitted to fly off the runway.

Note

Takeoff with asymmetric loads imposes a requirement for large directional control inputs during the high acceleration phase of the takeoff roll. Nosewheel steering and differential braking may be required to maintain directional control.

Flight

In general, flight control can be maintained with any one unbalanced store on any station within the loading spectrum certified for the A-37. At airspeeds above 200 KIAS, sufficient aileron and rudder trim is available to permit trimming off all control forces for one G flight and above 300 KIAS there is sufficient flight control effectiveness to effect a 5 G recovery from asymmetric stores deliveries.

WARNING

The requirement to provide large aileron control inputs should be anticipated on all stores deliveries in the event that an asymmetric loading should intentionally or inadvertently result. If possible, make all turns away from the heavy wing, especially at low airspeed.

Landing with Asymmetric Loads

Due to limited aileron effectiveness of the A-37 at low airspeed, landings should not intentionally be made with asymmetric loading unless moment differential is less than 50, 000 inch-pounds. In the event of an asymmetric load due to fuel unbalance, proceed as outlined in Section II, Fuel Unbalance.

In the event an asymmetric load results from inability to expend a particular store, proceed as follows:

1. Make every effort to reduce the asymmetric load prior to landing. This may be accomplished by attempting to selectively drop other stores on the heavy wing or selectively using tip or wing fuel from the heavy wing. Land heavy rather than asymmetric.

WARNING

A malfunction of the emergency jettison system could result in one wing being cleaned with the other retaining all stores. Therefore, use of the emergency jettison system to balance an asymmetric load should be made only as a last resort.

2. At a safe altitude, determine the minimum control speed in the landing configuration. If this speed is above 110 KIAS with full flaps attempt to reduce the asymmetry by use of the emergency jettison system. If the amount of asymmetry cannot be reduced, and the minimum control speed is above 110 KIAS, maintain airspeed above minimum control speed and abandon the aircraft in a safe area.

WARNING

If at anytime during the flight near minimum control speed, insufficient aileron control is available to prevent a roll in the direction of the heavy wing, or if stall is approached, recovery can only be accomplished by reducing pitch attitude and adding power to increase airspeed above minimum aileron control speed. Do not continue controllability check below 100 KIAS.

3. If minimum aileron control speed in between 100 and 110 KIAS, landing should only be made under ideal conditions. Consideration should be given to pilot proficiency, runway length, width and surface conditions, weather conditions, visibility, crosswind, gusts, etc. Beware of wake turbulence.
4. If the decision is made to land the aircraft, plan a flat, power on, straight in approach. Fly final approach 20 knots above minimum control speed. Use as little flare as possible, and make a normal touchdown. Touchdown on the side of the runway away from the heavy wing. Maintain an airspeed of 10 - 15 knots above minimum control speed with power until touchdown.

WARNING

Do not permit the aircraft to contact the runway nose wheel first, or an uncontrollable porpoise will result. The A-37 may be expected to land nose wheel first above 125 KIAS with full flaps extended, or 135 KIAS with no flaps.

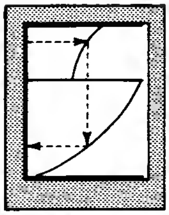
Note

- Investigation into the advisability of using an intermediate flap setting for landing with asymmetric loading has not been completed. Until further information on this subject is provided, use full flaps for landing.
- No data is available on effects of crosswinds and gusts.

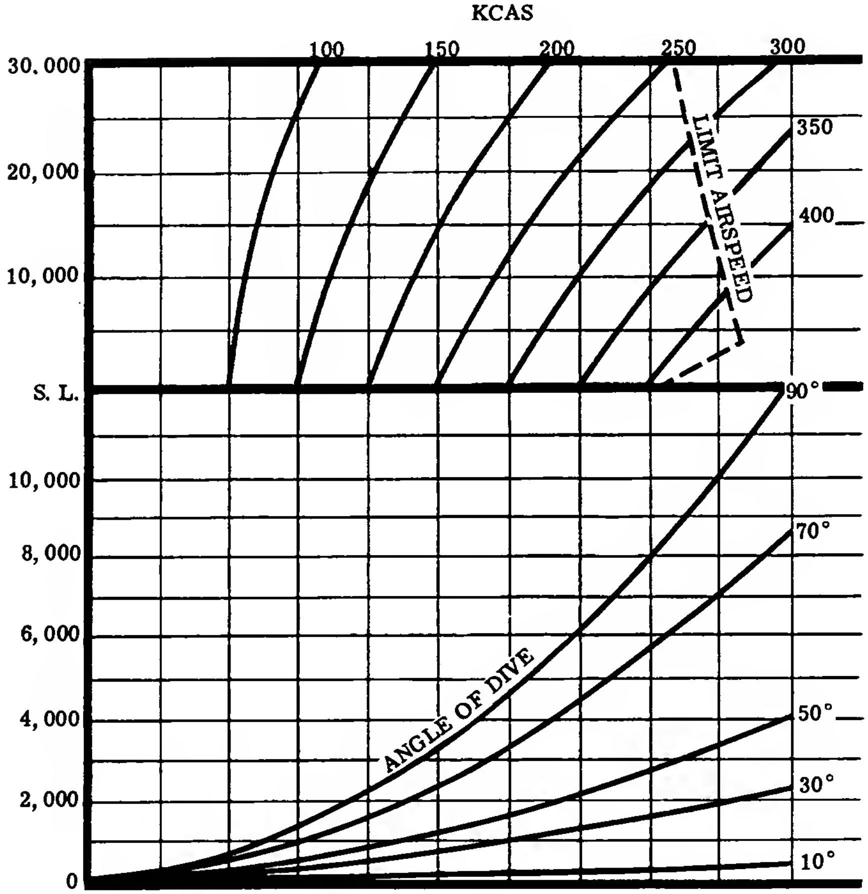
5. After touchdown, smoothly lower the nose wheel to the runway and engage nose wheel steering. Maintain directional control with a combination of nose wheel steering and differential braking. If directional control or stopping distance become critical, shutdown the engine away from the heavy wing.

Figure 6-3 is presented for background information as to what minimum trim speed and minimum control speed can be expected for various asymmetric stores at the four stations available. In all cases, the pilot should make the minimum control speed check at a safe altitude prior to a landing approach with asymmetric loads.

ALTITUDE LOSS IN DIVE RECOVERY



CONSTANT **3G** PULL-OUT



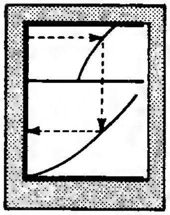
HOW TO USE CHARTS

Select appropriate chart, depending upon acceleration (3G, 4G or 5G) to be held in pull-out; then -

1. Enter chart at altitude line nearest actual altitude at start of pull-out.
2. On scale along altitude line, select point nearest the CAS at which pull-out is started.
3. Sight vertically down to point on curve of dive angle directly below airspeed.
4. Sight back horizontally to scale at left to read altitude loss during pull-out.

Figure 6-2. Altitude Loss in Dive Recovery (Sheet 1 of 3)

ALTITUDE LOSS IN DIVE RECOVERY



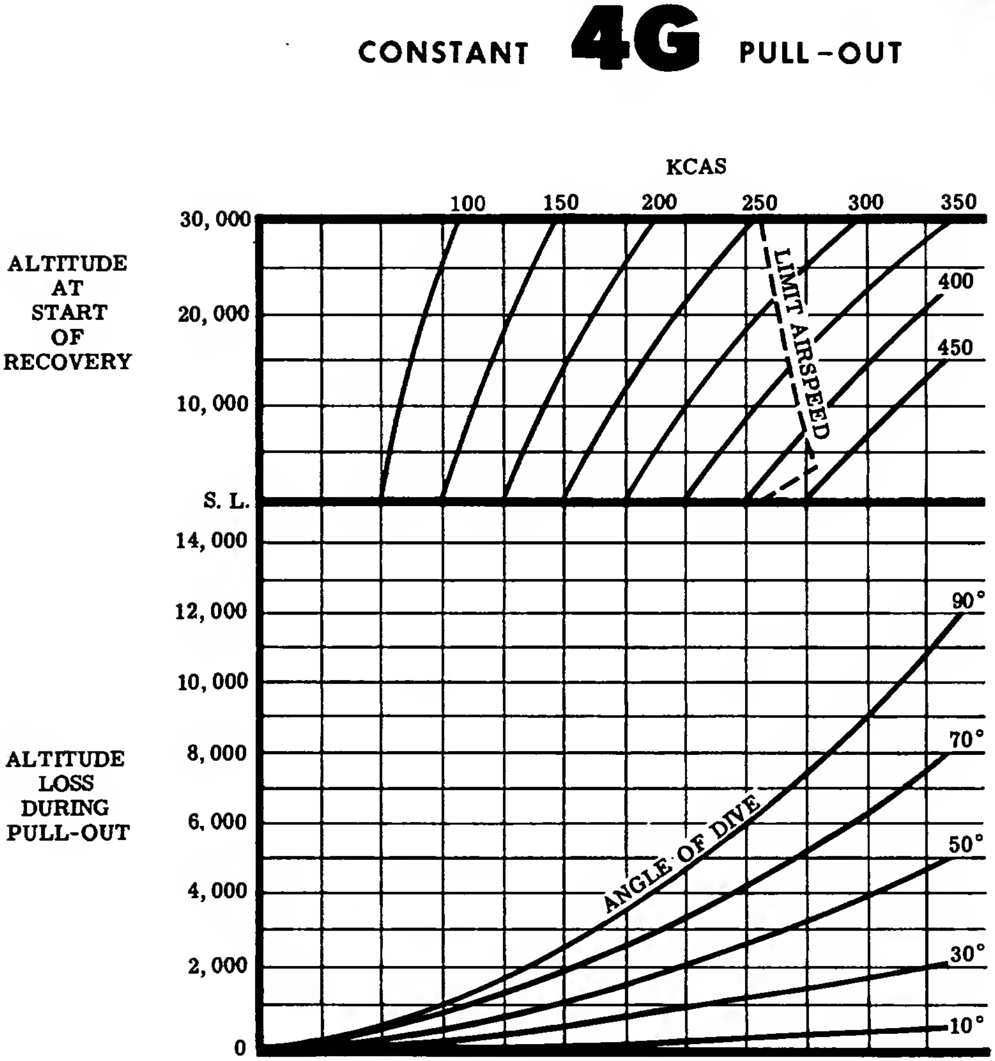
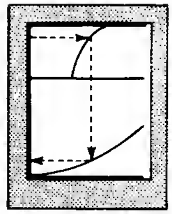


Figure 6-2. Altitude Loss in Dive Recovery (Sheet 2 of 3)

ALTITUDE LOSS IN DIVE RECOVERY



CONSTANT **5G** PULL-OUT

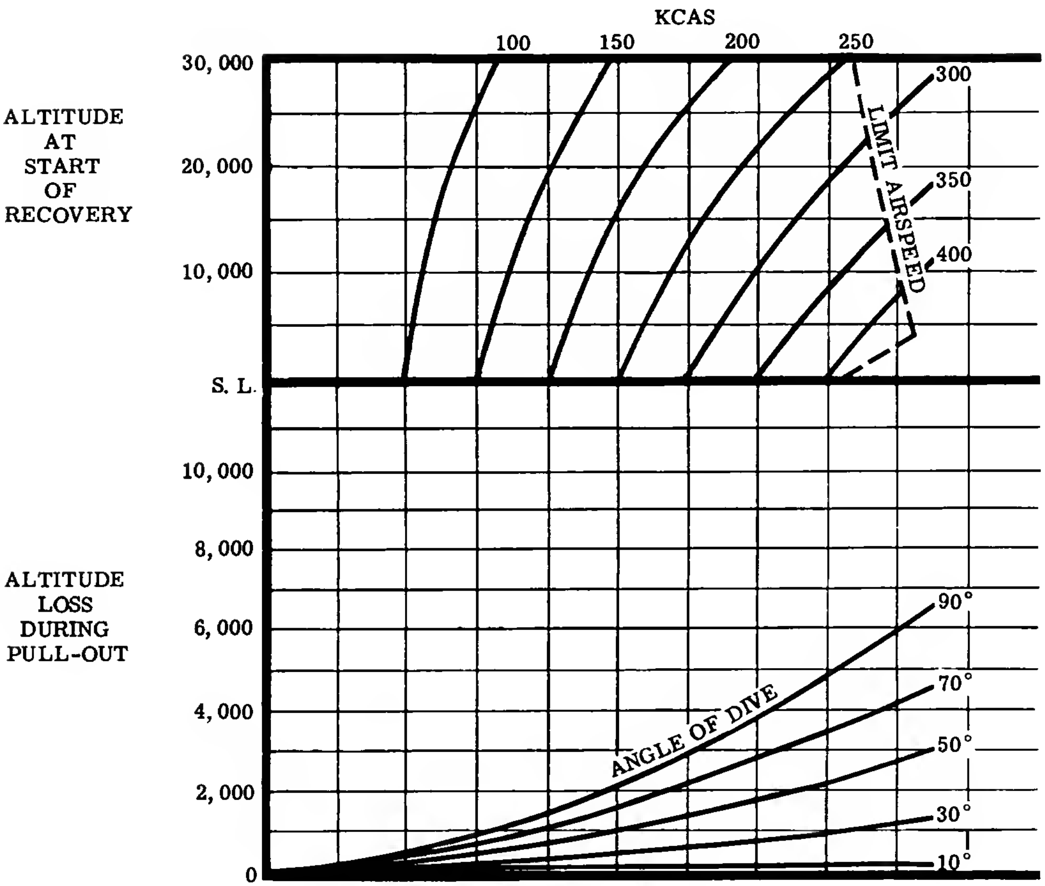
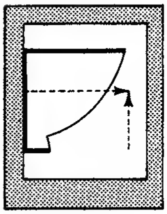


Figure 6-2. Altitude Loss in Dive Recovery (Sheet 3 of 3)



IDLE RPM vs ALTITUDE

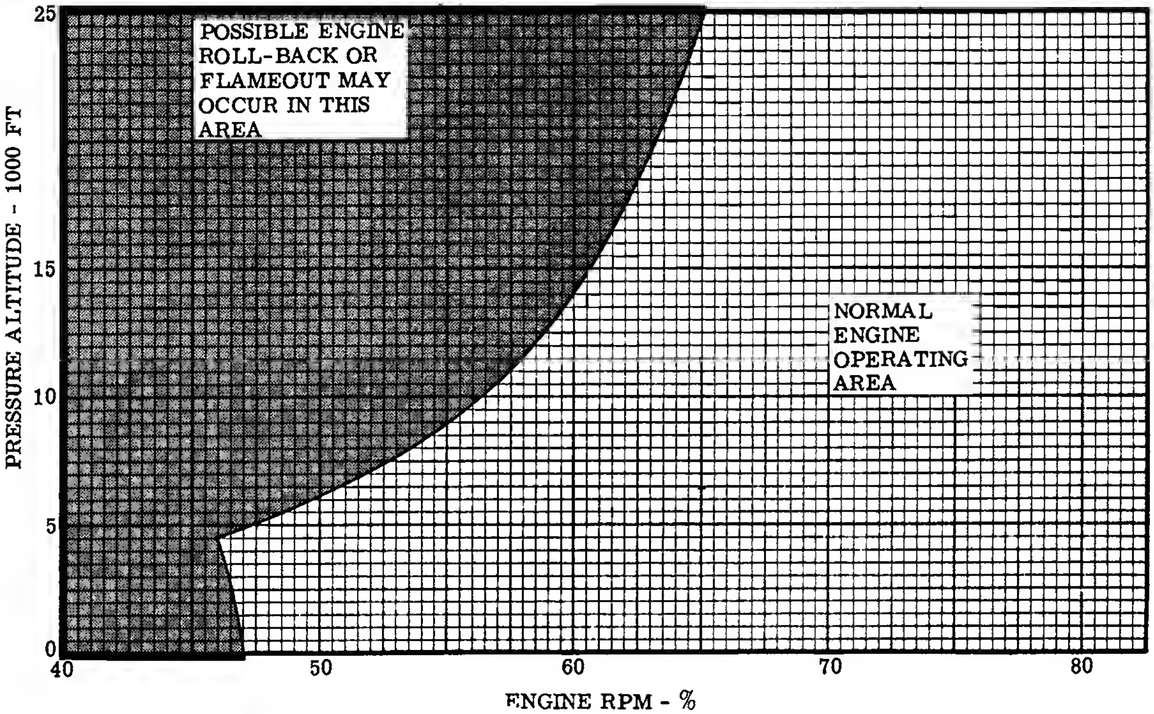


Figure 6-4

The pilot is required to manually maintain the minimum idle rpm as depicted in the above chart. When performing idle penetration descents, the above schedule must be maintained.

CAUTION

If engine roll-back should occur, lower nose and increase airspeed. If flameout occurs, restart using normal airstart procedures.

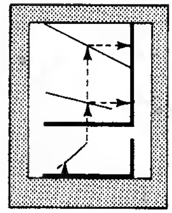
MINIMUM AILERON CONTROL AND AILERON TRIM CONTROL SPEEDS FOR ASYMMETRICAL LOADING

MODEL: A-37B
DATE: 1 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

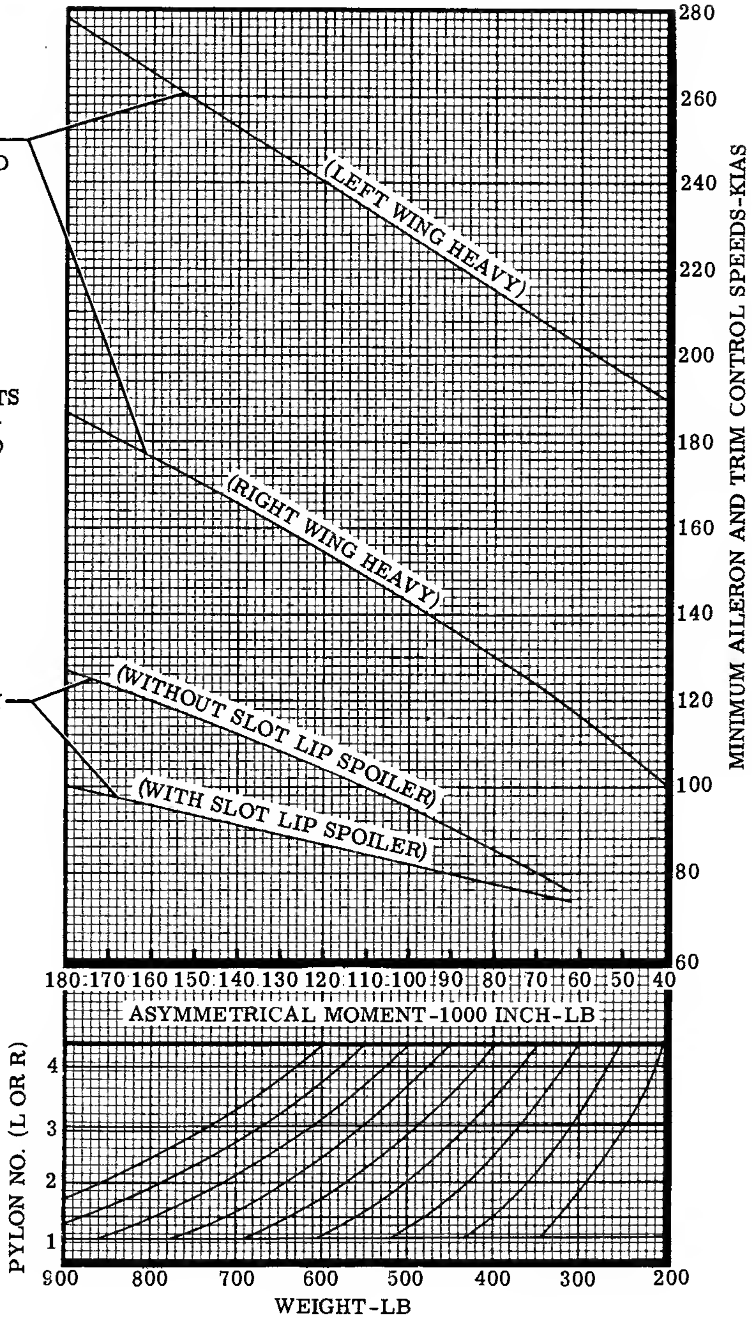
NOTE

FOR MULTIPLE STORES, ADD MOMENTS FOR ALL STORES BEFORE DETERMINING MINIMUM AILERON AND TRIM CONTROL SPEED.

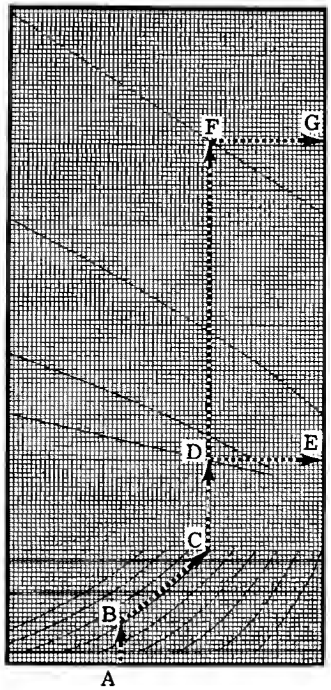


WARNING

MINIMUM SPEED SHOWN MAKES NO ALLOWANCE FOR TURBULENCE, GUSTS OR CROSSWIND. A MINIMUM OF 20 KIAS SHOULD BE ADDED FOR FINAL APPROACH.



SAMPLE PROBLEM.



Given:

(1) Asymmetric load of 650 pounds on L2 pylon (left wing heavy)
(2) Aircraft equipped with slot lip spoilers

Find:

(1) Minimum aileron control speed
(2) Minimum aileron trim control speed

Solution:

A. Is entry point for asymmetric weight of 650 pounds.
B. Is L2 pylon guide line.
C. Is reference line for determination of asymmetric moment.
D. Is guide line for minimum aileron control speed with slot lip spoilers.
E. Is minimum aileron control speed of 80 KIAS.
F. Is guide line for minimum aileron trim control speed with left wing heavy.
G. Is minimum aileron trim control speed of 222 KIAS.

SECTION VII

ALL-WEATHER OPERATION

TABLE OF CONTENTS

Note

Except for some repetition necessary for emphasis, clarity, or continuity of thought, this section contains only those procedures that differ or are in addition to normal operating instructions covered in Section II.

INSTRUMENT FLIGHT PROCEDURES

INTRODUCTION

This aircraft has the same stability and flight handling characteristics during instrument flight conditions as when flown under VFR conditions. Instrument flight through thunderstorms, icing conditions, or reliance upon radar control for instrument approaches in heavy or severe weather conditions is not recommended. Radio and navigation equipment in the aircraft will enable the pilot to make three types of instrument approaches; TACAN, ADF and radar. Special attention should be given to preflight fuel planning, since certain phases of instrument flying may require unexpected delays such as departure delays, holding, and the additional time required for approach procedures. Particular attention should be given to the flight instrument, radio, and navigation equipment to insure that each is operating properly. Consult Appendix I for flight planning information and use particular care in planning an alternate destination. The following techniques are recommended from takeoff to touchdown under instrument or night flying conditions.

INSTRUMENT TAKEOFF

Complete the normal TAXI and BEFORE TAKEOFF check as prescribed in Section II and check the BDHI. Adjust attitude indicator to superimpose the miniature aircraft and the horizon bar. Use nose wheel steering for directional control until rudder becomes effective at approximately 60 KIAS. While runway markings remain visible, they should be used as an aid in maintaining proper heading. At approximately 10 KIAS below computed takeoff speed, increase pitch attitude to 5° nose high on the MM-3. Maintain this attitude, until the aircraft flys off the runway.

When the altimeter and vertical velocity indicator indicate a positive climb, retract the landing gear and flaps at a minimum of 110 KIAS. Maintain a minimum vertical velocity of 500 feet per minute until tech order climb speed has been attained.

INSTRUMENT CLIMB

Refer to Appendix I for the best climb data. Turns should not be attempted below 500 feet above the terrain and for ease and precision of flight, limit all turns to 30° bank angle.

INSTRUMENT CRUISING FLIGHT

Instrument cruise procedures do not differ from normal flight procedures. For ease and precision of flight, the angle of bank should be limited to 30° during all turns.

Note

The aircraft has a tendency to bounce and yaw when flying in light to moderate turbulence.

RADIO AND NAVIGATION EQUIPMENT

Refer to Section I for radio and navigation equipment installed in the aircraft.

HOLDING

Recommended holding pattern airspeed is 190 KIAS above 14,000 feet and 160 KIAS at or below 14,000 feet. To descend when holding, reduce power to 65% RPM minimum and maintain holding pattern airspeed, using speed brake as desired.

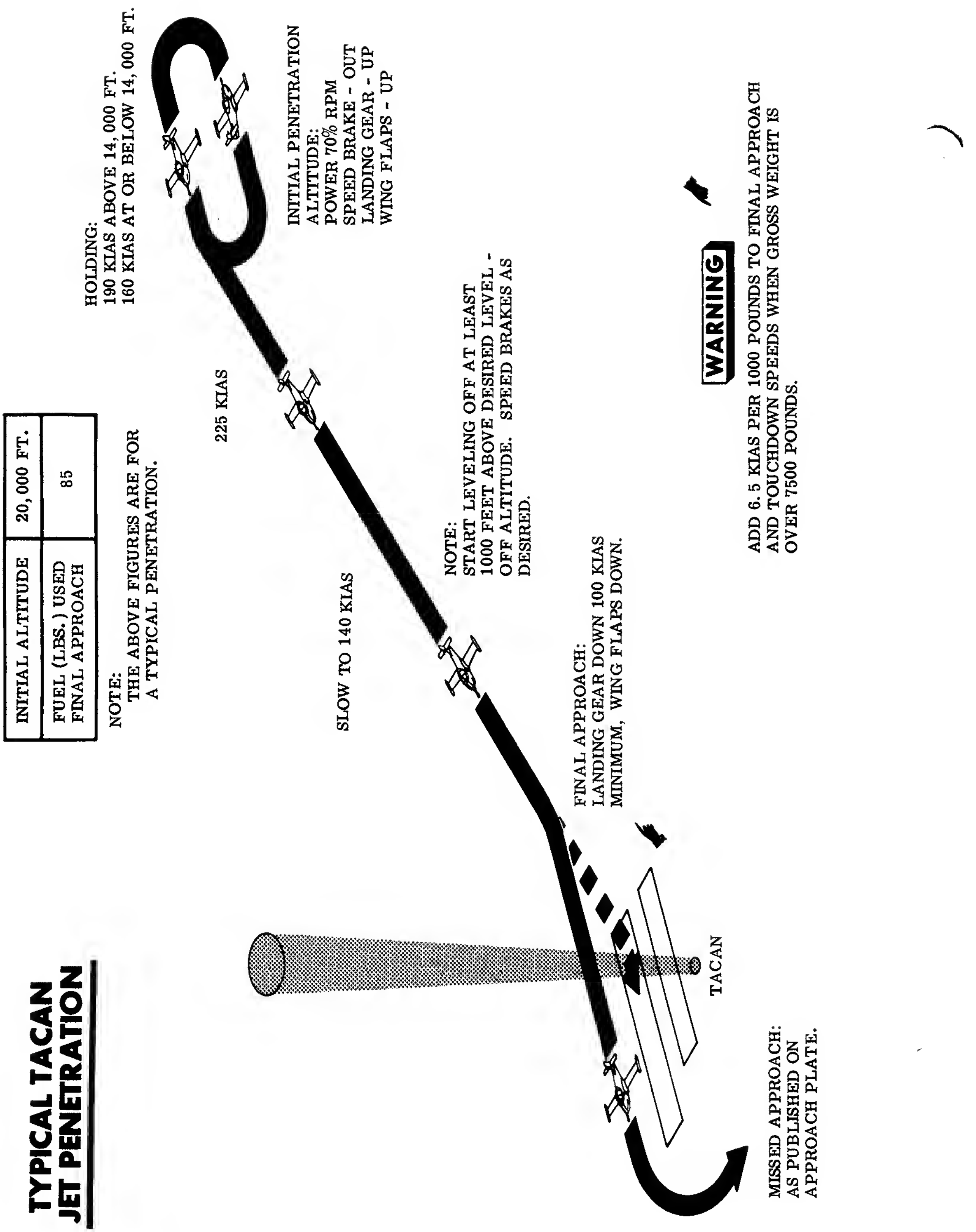
DESCENT AND PENETRATION

Descents to initial penetration altitude, before reaching the destination fix, may be made at the airspeeds and power settings given in Part VII of Appendix I. Descents from initial penetration altitude or lower should be made using normal penetration procedures.

Note

Various power settings can be used and descents can be made up to the maximum allowable airspeed for the aircraft. However, 180 KIAS produces the most satisfactory flight characteristics in turbulence.

For a normal penetration, starting at initial penetration altitude, reduce the power to 70% and simultaneously lower the pitch attitude approximately 10° on the MM-3 attitude indicator to establish 225 KIAS. Extend the speed brakes and maintain 225 KIAS.



INITIAL ALTITUDE	20,000 FT.
FUEL (LBS.) USED FINAL APPROACH	85

Figure 7-1

Note

- The cockpit and windshield should be kept as warm as possible before and during descents to eliminate fogging conditions on the canopy during rapid descents.
- Pilot should be aware that aerobatics will induce gross precession errors in the attitude indicator.

Figure 7-1 shows a typical TACAN jet penetration and instrument approach; however, the published procedures for jet penetration may vary at USAF, Navy and civil installations. Consult the Flight Information Publication (Terminal) for current approach to your destination during the planning phase of your flight.

Start level off from the penetration descent at 1000 feet above the desired altitude by decreasing the pitch attitude on the attitude indicator by one-half. When reaching the normal lead point (approximately 10% of the vertical velocity), slowly raise the nose of the aircraft to level off at the desired altitude. The speed brake is normally retracted when initiating the level off; however, it may be left extended to obtain the desired airspeed and configuration at the final approach fix. This will depend upon when the descent was begun, the type of approach to be made, and the distance/time from the station to the field. After level off, maintain a minimum of 65% rpm and a minimum of 140 KIAS to the station. Lower the landing gear and maintain a minimum of 120 KIAS prior to or over the station depending upon the type of approach.

INSTRUMENT APPROACHES

Aircraft performance differences have a direct effect on the airspace and visibility needed to perform certain maneuvers, such as circle to land, turning, missed approaches, final alignment correction to land, and descent. This aircraft will use Category C approach minimums.

Figure 7-1 shows a typical TACAN approach, and Figure 7-2 shows a standard rectangular version of the basic radar pattern. With heavy fuel loads or turbulent conditions, it may be necessary to use higher than normal power to maintain the desired indicated airspeeds. Normally, a minimum of 140 KIAS is used for all maneuvering prior to the actual approach. For the approach, attain landing configuration (landing gear and flaps) and maintain a minimum 120 KIAS. For a straight in or circling approach, maintain a minimum of 120 KIAS during the base leg and a minimum of 100 KIAS on final approach. To descend with a clean aircraft configuration, extend the speed brake and maintain a minimum of 65% rpm. To descend in the landing configuration, vary the power to maintain the recommended approach airspeed. Use of speed brake is optional.

WARNING

Add 6.5 KIAS per 1000 pounds to base leg, final approach and touchdown speeds when the gross weight is over 7500 pounds.

MISSED APPROACH

The recommended procedure for executing a missed approach is to apply power as required, retracting speed brake as power is applied, and establish an instrument takeoff attitude. Gear and flaps should then be retracted. When the climb airspeed reaches a minimum of 140 KIAS, reduce power to approximately 85% until reaching missed approach altitude. When the desired altitude is reached, reduce power to maintain a minimum of 140 KIAS or a minimum power setting of 65% rpm.

Note

If speed brake is used on final approach, opening and closing of the thrust attenuators will occur when power is adjusted near the 60% rpm power setting.

SINGLE ENGINE APPROACH

Refer to Section III for single engine landing procedures. If a single engine penetration is required, proceed as in a normal penetration except use 75% rpm on the operating engine and retract the speed brake when initiating the level off at 1000 feet above the desired altitude.

RADAR LETDOWNS

Radar letdowns of various types can be made in this aircraft. By proper radar control techniques for the letdown and turn onto final approach, maximum economy of fuel and time can be realized.

ICE AND RAIN

ICE

Icing of the air intake area is an ever-present possibility during operation in weather with temperature near the freezing point. An engine ice warning light, located on the instrument panel, will illuminate when ice forms over the ice detect probe located in the left engine air inlet duct. This may be the only noticeable indication of ice formation until ice ingestion occurs.

Cruising in areas of known or suspected icing conditions is not recommended. Ice will normally adhere to the windshield, wing leading edges, empennage, air inlet areas and inlet screens if extended. Altitude should be changed immediately upon the first sign of ice accumulation. Ice accumulation on the empennage will cause the elevators to freeze to the horizontal stabilizer. Ice accumulation on the air intake area may cause both engines to flameout by ice ingestion. The windshield defroster is not effective in preventing the formation of ice or removing it from the windshield. Vision through it will become extremely limited and ice removal can only be obtained by leaving the icing area. The resultant drag associated with aircraft ice accretion on external surfaces acts to reduce the airspeed and to increase

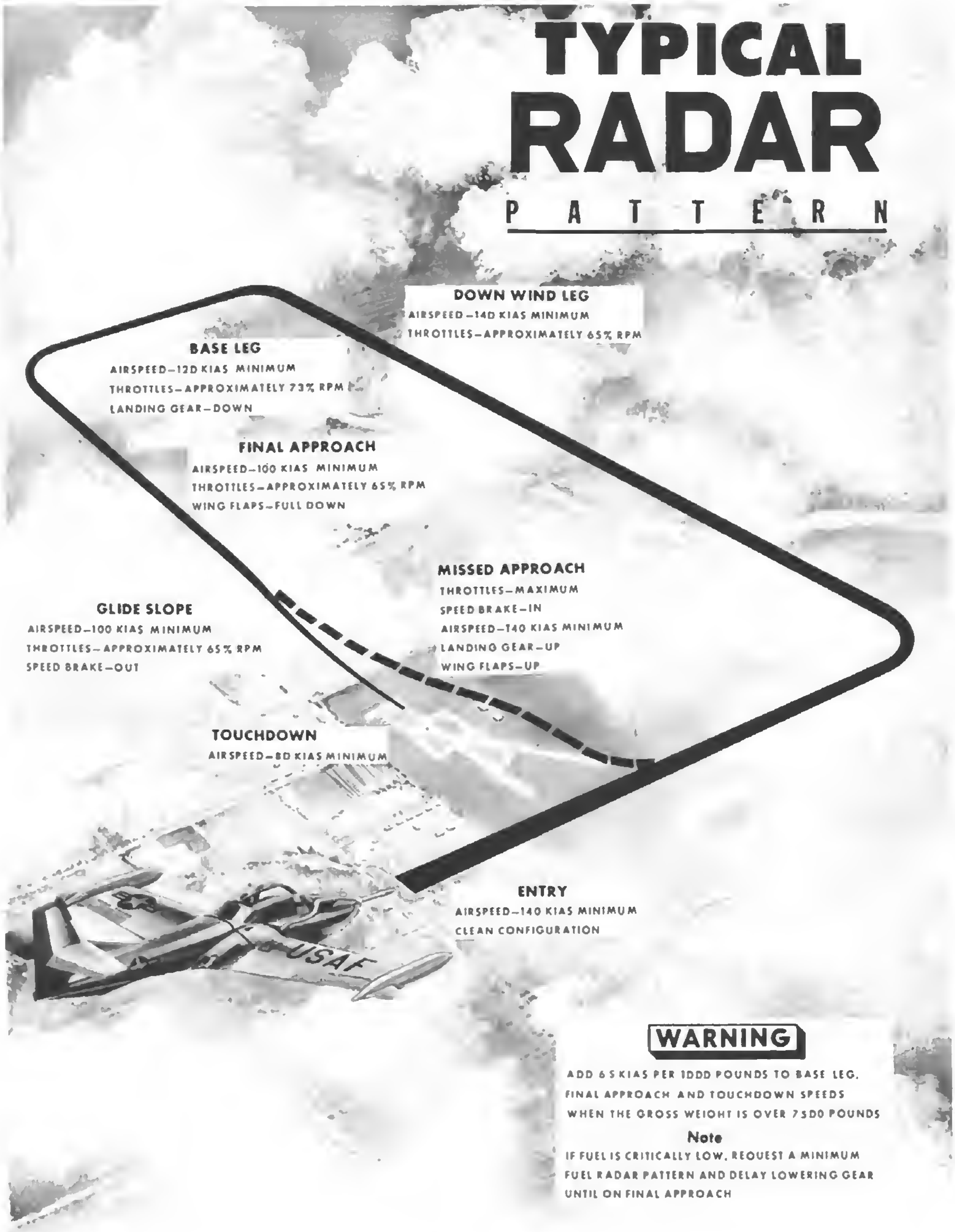

TYPICAL
RADAR
PATTERN
DOWN WIND LEG
AIRSPEED–140 KIAS MINIMUM
THROTTLES–APPROXIMATELY 65% RPM
BASE LEG
AIRSPEED–120 KIAS MINIMUM
THROTTLES–APPROXIMATELY 73% RPM
LANDING GEAR–DOWN
FINAL APPROACH
AIRSPEED–100 KIAS MINIMUM
THROTTLES–APPROXIMATELY 65% RPM
WING FLAPS–FULL DOWN
MISSED APPROACH
THROTTLES–MAXIMUM
SPEED BRAKE–IN
AIRSPEED–140 KIAS MINIMUM
LANDING GEAR–UP
WING FLAPS–UP
GLIDE SLOPE
AIRSPEED–100 KIAS MINIMUM
THROTTLES–APPROXIMATELY 65% RPM
SPEED BRAKE–OUT
TOUCHDOWN
AIRSPEED–80 KIAS MINIMUM
ENTRY
AIRSPEED–140 KIAS MINIMUM
CLEAN CONFIGURATION
USAF
WARNING
ADD 6.5 KIAS PER 1000 POUNDS TO BASE LEG, FINAL APPROACH AND TOUCHDOWN SPEEDS WHEN THE GROSS WEIGHT IS OVER 7500 POUNDS
Note
IF FUEL IS CRITICALLY LOW, REQUEST A MINIMUM FUEL RADAR PATTERN AND DELAY LOWERING GEAR UNTIL ON FINAL APPROACH

Figure 7-2

the power requirements with consequent reduction of range and may adversely affect flight stability.

WARNING

- When flying in icing conditions be constantly alert for the elevators freezing to the horizontal stabilizer. Considerable force is required to break the elevators loose. Leave the area of icing as soon as possible.
- Ice accumulations will greatly increase the stalling speed; therefore, extreme caution must be exercised when landing under such conditions.
- When flying in icing conditions, the airspeed indicators may give erroneous or unusable readings even with pitot heat on.

CAUTION

Do not position the screens in the UP position whenever the environmental conditions are such that icing is likely to occur. Screen operation in the UP mode during an icing condition may lead to screen icing which may have a significant effect on engine operation; possibly engine flameout.

Note

Ice breaking loose from the nose area will strike the tail; the impact will be alarming but normally will cause no damage.

If icing conditions are encountered at freezing atmospheric temperatures, change altitude rapidly by climbing or descending.

The anti-ice inlet switch controls the anti-ice inlet heat for prevention of ice buildup. The system is for anti-ice and not de-ice. Once ice has formed the possibility of the system overcoming ice buildup is practically zero. When the anti-ice switch is ON, the inlet heat light on the annunciator panel will illuminate. The other indication is a 10° to 20° C rise in EGT. Maintain 80% RPM or greater to insure proper anti-ice operation.

Note

Turn on anti-ice system prior to entering any known or suspected ice condition.

RAIN

WARNING

Do not apply repellent fluid to a windshield that is dry or wetted by only a light rain since a milk film will result that impairs visibility. Do not make frequent consecutive applications in moderate rain as an oily residue will form on the windshield which can affect pilot visibility.

Prior to entering an area of precipitation, turn pitot heat on. Apply rain repellent fluid to the windshield when encountering moderate and heavier rain conditions after the windshield has become wetted so that dispersal of the rain will be enhanced.

TURBULENCE AND THUNDERSTORMS

CAUTION

Flight through thunderstorms or other areas of extreme turbulence should be avoided. Maximum use of weather forecast facilities and ground radar to aid in avoiding thunderstorms and turbulence is essential.

Should flight through an area of thunderstorm activity become necessary, the following recommended procedures should be followed:

1. Preparation - Turn on pitot heat, tighten seat belt, lock shoulder harness, and stow loose items. At night, use white lighting to minimize blinding effect of lightning.

Note

Make every effort to avoid looking up from the instrument panel at lightning flashes. The blinding effect of lightning can be reduced by lowering the seat.

2. Airspeed - A penetration airspeed of 180 KIAS should be established. Trim the aircraft for level flight at this speed. Severe turbulence may cause large and rapid variations in indicated airspeed. Do not chase the airspeed.
3. Attitude - The key to proper flight technique through turbulence is attitude. Both pitch and bank should be controlled by reference to the attitude indicator. Do not change trim after the proper attitude has been established. Extreme gusts will cause large attitude changes. Use smooth and moderate aileron and elevator control inputs to re-establish the desired attitude. To avoid over-stressing the aircraft, do not make large or abrupt attitude changes.
4. Thrust - Establish and maintain the thrust setting consistent with the desired penetration and altitude.
5. Altitude - Severe vertical gusts may cause appreciable altitude deviations. Allow altitude to vary. Sacrifice altitude to maintain desired attitude. Do not chase the airspeed.

IN THE STORM

When in the storm, maintain power setting and level flight attitude. Do not attempt to compensate for changes in indicated airspeed or altitude. Concentrate on maintaining a constant attitude and heading. Do not make any turns unless absolutely necessary.

NIGHT FLYING

During normal VFR flight, unfiltered lights should be used sparingly. Reflections in the canopy may be reduced by lowering the intensity of all cockpit lights.

CAUTION

Damage to the landing light extension motors may be caused by extending the lights above 156 KIAS.

Note

- When making VFR takeoffs in areas of limited horizon references, referral to the flight instruments is recommended to avoid flying back into the ground after takeoff.
- During night weather, reflections from the anti-collision lights on clouds or precipitation may create a distraction to the pilot and induce partial disorientation. If so, the anti-collision beacons should be turned off until clear of the area of reduced visibility.

COLD WEATHER PROCEDURES

The success of low temperature operation depends primarily upon the preparations made during the post-flight inspection, in anticipation of the requirements for operation on the following day. In order to expedite preflight inspection and insure satisfactory operation for the next flight, normal operating procedures outlined in Section II should be adhered to with the following additions and exceptions.

BEFORE ENTERING AIRCRAFT

Remove all protective covers and dust plugs and check that the entire aircraft is free from frost, snow, and ice. Depending upon the weight of snow and ice accumulated, takeoff distances and climb out performance can be seriously affected. The roughness and distribution of the ice and snow could vary stall speeds and characteristics to an extremely dangerous degree. In view of the unpredictable and unsafe effects of such a practice, the ice and snow must be removed before flight is attempted. Brush off all light snow and frost. Remove ice by a direct flow of air from a portable ground heater.

WARNING

- Care should be taken to insure that water from melted ice is sponged so that it will not drain to some critical area and refreeze.
- Insure that water is drained from the fuel tanks before cold weather operations.

If during operation of the canopy, it is found that the raising or lowering puts undue strain on the canopy motor or hinges, preheat should be applied to insure normal operation. Be sure that the fuel tank vents, fuel filter, and drain cocks are free from ice and drain condensate. Check that the static air, pitot tube, and transducer vane are free of ice. If ice within the engine is suspected, check the engine for freedom of rotation. If engines are not free, external heat must be applied to forward engine section to melt the ice. Check shock struts and actuating cyl inders for dirt and ice.

ON ENTERING THE AIRCRAFT

Check flight controls for proper operation and insure that canopy can be closed and locked. To conserve the battery, use external power to operate all electrical and radio equipment.

STARTING ENGINES

Start the engines using the normal starting procedure outlined in Section II. Oil pressure may be high after starting cold engines. This is not dangerous unless the pressure remains high. Takeoff should not be made until oil pressure drops to normal.

Note

If normal starting rpm (6 - 8%) cannot be obtained, stop the start and connect an adequate power source.

WARMUP AND GROUND CHECK

Turn on cabin heat and windshield defrosting system as required, immediately after starting engines. Check the speed brake, thrust attenuators, and trim tabs for proper operation. Check the wing flaps and flap indicator for operation. If questionable readings result, recycle the flaps three to four times as a check on the indicator action.

WARNING

Make sure all instruments have warmed up sufficiently to insure normal operation. Electric gyro instruments require approximately two minutes of warmup.

CAUTION

Because of low ambient temperatures, the thrust at all engine speeds is noticeably greater than normal. This should be remembered during all ground operations, and firmly anchored wheel chocks used for all engine runups.

TAXIING INSTRUCTIONS

Avoid taxiing in deep snow. Use only essential electrical equipment to preserve battery life while taxiing at low engine speeds. Increase space between aircraft while taxiing to provide safe stopping distance and to prevent icing of aircraft surfaces by melted snow and ice in the jet blast of preceding aircraft. Taxi speed should be reduced when taxiing on slippery surfaces to avoid skidding. Inlet screens should be retracted. Ice buildup is very rapid on the screens and will cause high engine temperature or engine flameout. The anti-ice system should be on to prevent ice accumulation in the intake areas.

WARNING

Make sure all instruments have been sufficiently warmed up to insure normal operation. Check for sluggish instruments during taxiing.

TAKEOFF

Make final instrument check during the first part of the takeoff as the brakes will not hold the aircraft on snow covered or icy runways at full throttle. Advance throttles smoothly or swerving may result.

Note

Nose wheel steering is essential for takeoff from icy runway.

AFTER TAKEOFF

If takeoff from a snow or slush covered field is made, the brakes should be operated several times to expel wet snow or slush, and the landing gear and wing flaps operated through several cycles to prevent their freezing in the retracted position.

CAUTION

Do not exceed the landing gear and wing flaps down limit airspeed during this operation.

DESCENT

Rapid descents generally cause a fogging condition to exist inside the canopy and windshield. Therefore, it is necessary that the pilot preheat the canopy and windshield approximately 10 minutes before a descent is made. A slight discomfort to the pilot may be encountered but preheating aids in preventing canopy and windshield fog.

WARNING

The collection of snow, frost and ice on the aircraft constitutes one of the major flight hazards in low temperature operation and will result in the loss of lift and in treacherous stalling characteristics.

CAUTION

Anti-icing of inlet duct and engine inlet parts require 80% minimum RPM.

APPROACH TO PATTERN

Make normal pattern and landing as outlined in Section II.

BEFORE LEAVING THE AIRCRAFT

Release brakes after wheels are chocked and leave canopy partly open to allow circulation winthin the cockpit to prevent canopy cracking from contraction and to reduce windshield and canopy frosting. Whenever possible, leave the aircraft parked with full fuel tanks. Every effort should be made during servicing to prevent moisture from entering the fuel system. Check that protective covers and dust plugs are in-

stalled, and that the battery is removed when aircraft is outside in temperatures below -29°C (-20°F), for more than four hours.

DESERT AND HOT WEATHER PROCEDURES

Hot weather and desert operation is identical with normal operation with few exceptions. Takeoff and landing rolls are longer due to lower air density. Added precautions should be taken to protect the rubber or plastic parts of the aircraft from damage by excessive heat.

BEFORE ENTERING THE AIRCRAFT

Inspect intake ducts for sand or other foreign objects. If excessive sand is found, do not start the engine. Inspect tires for blister, deterioration, and proper inflation. Check for hydraulic system leaks as heat and moisture may cause packing and valves to swell.

TAXIING INSTRUCTIONS

Taxi with minimum power to minimize the blowing of dust and sand into other aircraft. Keep adequate distance from any other aircraft taxiing ahead of you, and use brakes as little as possible to prevent overheating.

TAKEOFF

During takeoff, the aircraft will accelerate slowly and ground run will be longer because the air is less dense in hot weather. Ground speed will be increased for the same IAS.

AFTER TAKEOFF

Follow the normal flight procedures, being particularly careful to maintain throttle settings that will keep the exhaust gass temperature within the prescribed engine limitations.

DESCENT

Turn on defroster prior to descent since warm humid air is likely to cause canopy frosting in hot weather descents.

APPENDIX I

PERFORMANCE DATA

The appendix is divided into nine parts as follows: Part I, Introduction; Part II, Takeoff; Part III, Climb; Part IV, Range; Part V, Endurance; Part VI, Combat Allowance; Part VII, Descent; Part VIII, Landing; and Part IX, Mission Planning. These Parts are presented in proper sequence for preflight planning. Discussions and sample problems are given in each part.

TABLE OF CONTENTS

PART I INTRODUCTION

TABLE OF CONTENTS

INTRODUCTION.

The flight performance charts provide the pilot with sufficient data for preflight and in-flight planning. All charts are based on ICAO (International Civil Aviation Organization) Standard Day conditions. When necessary, temperature corrections for non-standard atmosphere have been included on the charts. Charts for climb, cruise, endurance and descent performance are presented in drag index form.

CALIBRATED AIRSPEED.

Calibrated airspeed (CAS) is indicated airspeed corrected for both error in the airspeed sensing system and in the airspeed indicator. The error in the indicator is usually very small and not available to the pilot and is, therefore, normally ignored for routine flying. Calibrated airspeed as used in this manual shall then be indicated airspeed corrected for airspeed sensing system (installation) error only by the values given in figure A1-1.

AIRSPEED CORRECTION.

Charts are provided to obtain calibrated airspeed (CAS), equivalent airspeed (EAS), and true airspeed (TAS). Ground speed (GS) is TAS corrected for wind.

INDICATED AIRSPEED.

Indicated airspeed (IAS) is read directly from the airspeed indicator.

ALTITUDE CORRECTION.

The error in indicated altitude is negligible and shall be indicated altitude corrected for installation error only by the value given in figure A1-2.

EQUIVALENT AIRSPEED.

Equivalent airspeed (EAS) is calibrated airspeed corrected for the effects of compressibility. Although this correction is negligible at low speed and low altitude, it may be as much as seven or eight knots at

higher speeds and altitudes. The corrections shown in the Compressibility Correction Charts (figure A1-3) are subtracted from the calibrated airspeed to obtain equivalent airspeed.

TRUE AIRSPEED.

True airspeed (TAS) is equivalent airspeed corrected for atmosphere density. The type CPU-26P dead-reckoning computer or figure A1-5 may be used for this correction.

SPEED CONVERSION CHART.

The Speed Conversion Chart (figure A1-4) is used to convert calibrated airspeed (CAS) directly to true airspeed (TAS). The compressibility effect has been included in this chart.

DENSITY ALTITUDE CHART.

The Density Altitude Chart (figure A1-5) is used to determine the density altitude and the value of $\sqrt{\frac{1}{\sigma}}$ for any pressure altitude and ambient temperature. To use the chart, enter with ambient temperature (corrected for compressibility) and read up to the appropriate pressure altitude line. Read to the left to find density altitude and to the right to find the value of $\sqrt{\frac{1}{\sigma}}$.

ICAO STANDARD ATMOSPHERE TABLE.

The ICAO Standard Atmosphere Table figure A1-6 gives the standard atmospheric values, as defined by ICAO, in increments of 1000 feet from sea level to 35,000 feet. The values of $\sqrt{\frac{1}{\sigma}}$ (Smoe), Density Ratio σ, temperatures, speed of sound, barometric pressure in inches Hg. and pressure ratio (δ), are given for each altitude increment.

DRAG NUMBERS.

The Drag Numbers Chart, figure A1-7, gives the drag number and approximate weight of each store that can be carried on the external racks. These drag numbers are used to compute the total drag index of the aircraft and are used to compute climb, cruise, combat and descent performance. It will be noted on the chart that certain stores will have a different drag number when installed on different wing stations. The rocket launchers also have different drag numbers when loaded than when empty. The clean configuration drag index of 0 is applicable to the gear and flaps up configuration with two tip tanks, eight pylons with bomb racks, aerial refueling probe and nose gun installed.

The drag index of a loaded aircraft is computed by adding the drag numbers for all stores. The following sample of loading configuration illustrates a typical drag index for a mission requiring mixed stores, and the gross weight that would be used for initial preplanning of the fuel load.

Total drag index for each wing (symmetrical loading) is 146, or a total for both wings of 292. Gross weight of the loaded stores, is 4520. Assuming that all stores are expended, the drag index for return from the target area is figured on the rocket launchers and pylon tanks. Due to the increased drag of the rocket launchers after the rockets have been fired, the drag index for the return comes to [(30 + 78) 2 = 108 x 2 = 216].

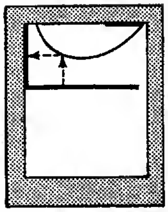
STATION	STORE	WEIGHT	NO. OF ADJACENT STORES	DRAG NUMBER
OUTBOUND:				
L1-R1	Pylon Tank	750	1	32
L2-R2	M117 GP Bomb	823	2	64
L3-R3	LAU-3/A Rocket Pod	427	2	38
L4-R4	MK 81 LD Bomb	260	1	12
INBOUND:				
L1-R-	Pylon Tank (Empty)	119	0	30
L3-R3	LAU-3/A Rocket Pod (Empty)	71	0	78

SYMBOLS AND DEFINITIONS.

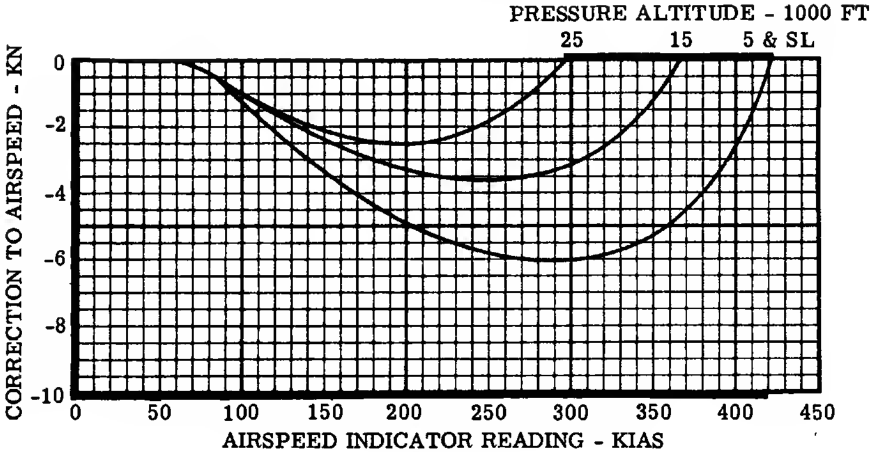
SYMBOLS	DEFINITIONS
CAS	Calibrated airspeed, indicated airspeed corrected for position error: CAS = IAS + correction.
Δ	Delta - "Change in" (e.g., temperature).
(δ)	Delta - Ratio of ambient air pressure to standard sea level air pressure.
EAS	Equivalent airspeed, calibrated airspeed corrected for compressibility: EAS = CAS - correction.
GS	Ground speed, true airspeed corrected for the wind component velocity: GS = TAS + V_w.
H_d	Density altitude, that value obtained from the density altitude chart, figure A1-5, at which air density at the observed pressure altitude equals air density as defined by the International Civil Aviation Organization (ICAO).

SYMBOLS	DEFINITIONS
Hg	Mercury
IAS	Indicated airspeed, airspeed indicator uncorrected. Where this symbol (IAS) is used on the performance charts, mechanical error in the instrument is assumed to be zero.
Kn or Kts	Knots, Nautical miles per hour.
OAT	Outside air temperature.
ρ_o	Density of atmosphere at sea level in slugs/cubic feet.
P	Atmospheric pressure at any altitude (inches Hg).
P_o	Standard sea level pressure (29. 92 inches Hg).
ρ	Rho-Density of atmosphere at any altitude in slugs/cubic feet.
σ	Sigma-Ratio of density at altitude to density at sea level
$\frac{1}{\sqrt{\sigma}}$	Smoe - Correction factor for air density applied to TAS.
TAS	True airspeed, equivalent airspeed corrected for atmospheric density: TAS = EAS x $\frac{1}{\sqrt{\sigma}}$
V	True Airspeed.
V_W	Wind velocity component. Headwinds considered negative, tail winds considered positive.

AIRSPEED INSTALLATION CORRECTION

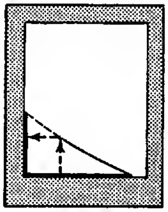


IN FLIGHT



Note

Calibrated airspeed equals indicated airspeed plus correction.



IN GROUND EFFECT

TAKEOFF CONFIGURATION

HALF AND FULL FLAPS

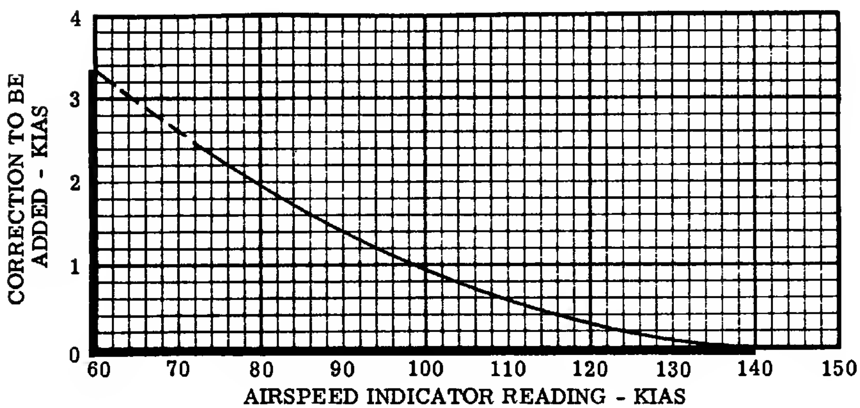
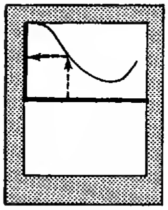
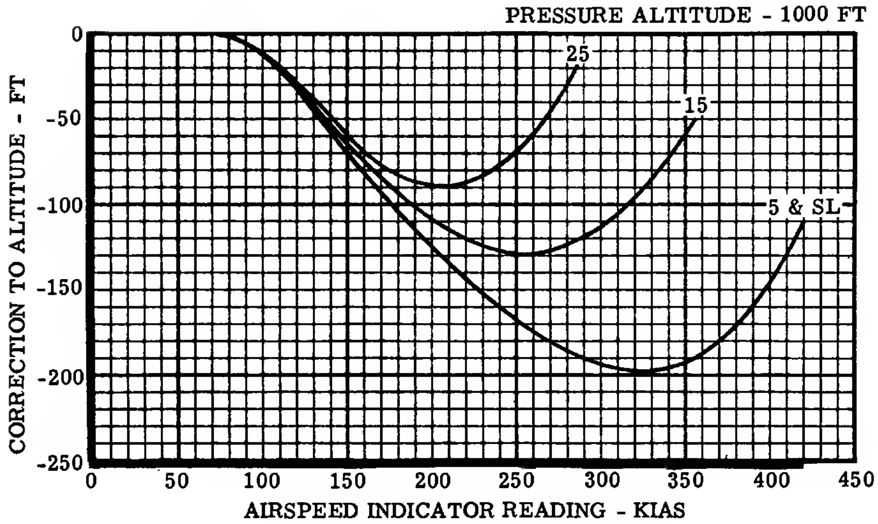


Figure A1-1

ALTIMETER INSTALLATION CORRECTION



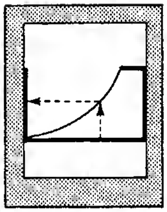


Note

Add correction to obtain indicated pressure altitude.

Figure A1-2

COMPRESSIBILTY CORRECTION CHART



SUBTRACT COMPRESSIBILITY CORRECTION FROM KCAS TO OBTAIN KEAS.

EXAMPLE: During flight at 20, 000 feet and 200 KCAS, Compressibility Correction is 3 knots. Subtract 3 from 200 to obtain 197 KEAS.

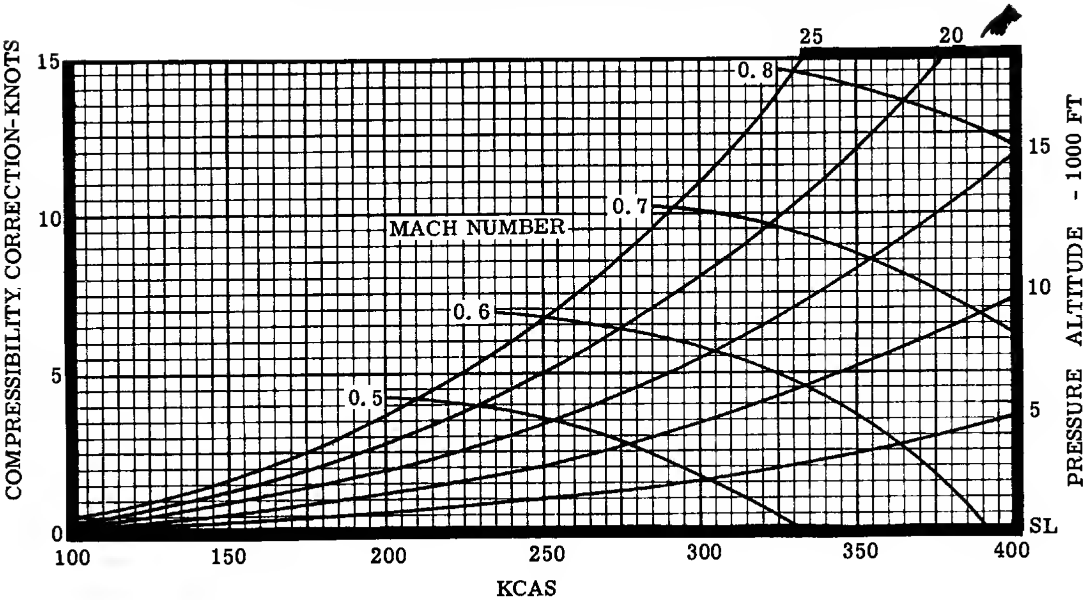
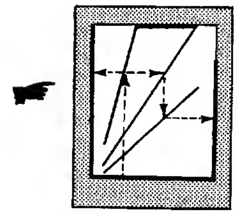


Figure A1-3

AIRSPEED CONVERSION



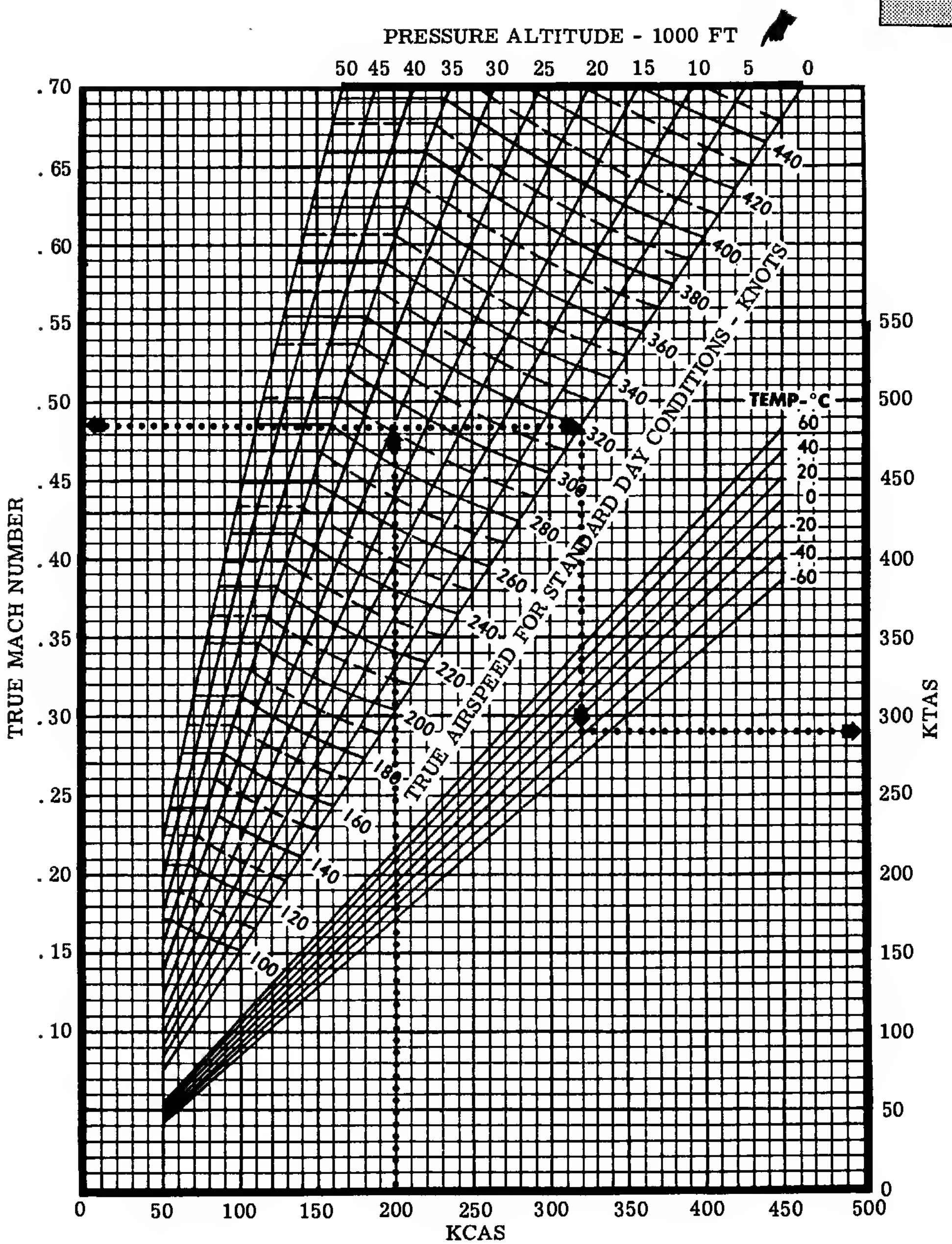
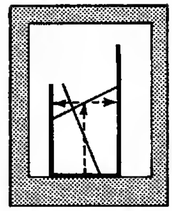


Figure A1-4

DENSITY ALTITUDE



EXAMPLE: IF AMBIENT TEMP. IS -15°C AND PRESSURE ALT. IS 6000 FEET, THE DENSITY ALT. IS 4000 FEET AND $\frac{1}{\sqrt{\sigma}}$ IS 1.06

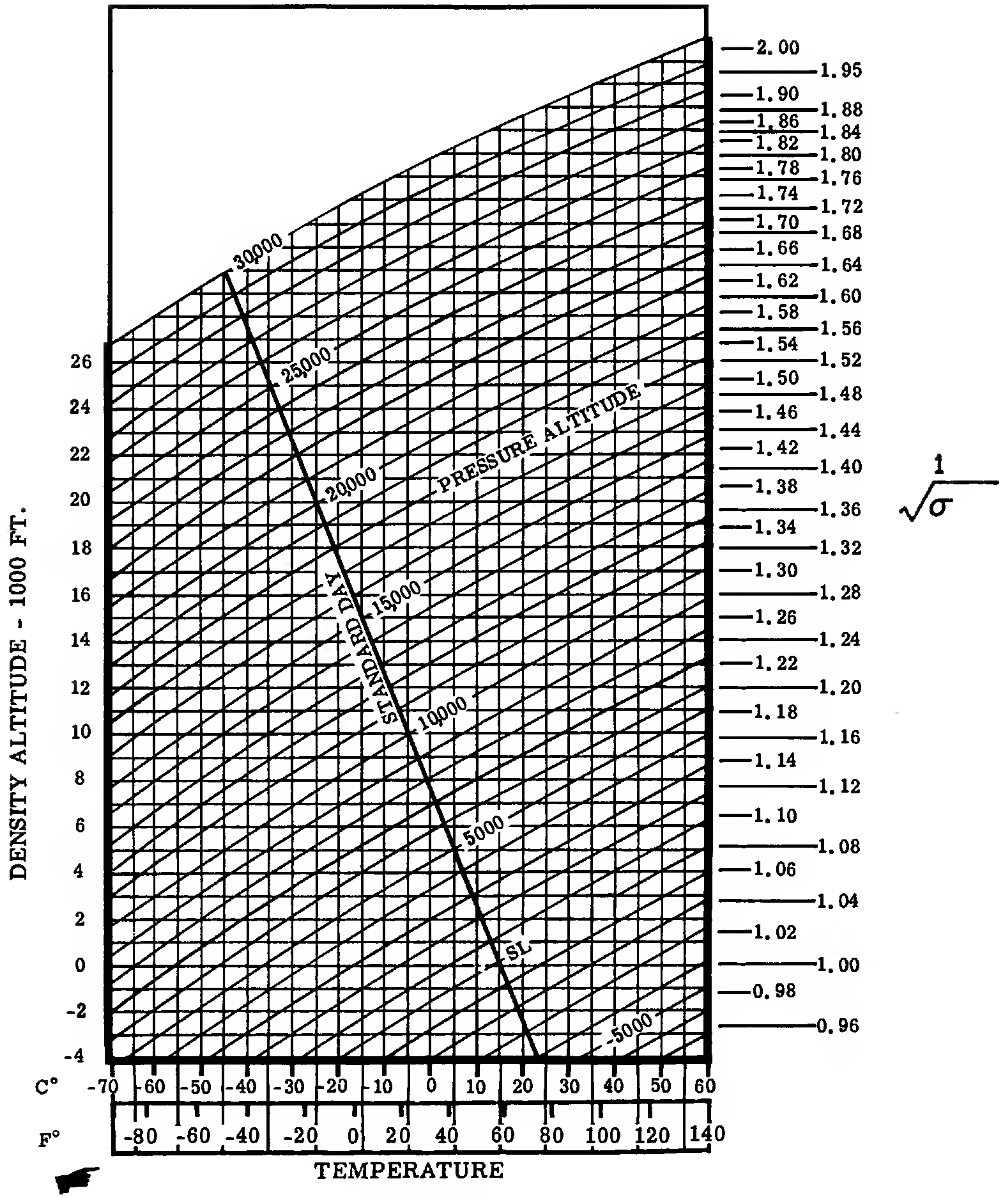


Figure A1-5

STANDARD ATMOSPHERIC TABLE

Standard Sea Level Conditions:
T = 15°C (59°F)
P = 29.921 in. of Hg. (2116.216 lb/sq. ft.)
Density = .0023769 Slugs/Cu. ft.
Speed of Sound = 1116.89 Ft./sec. (661.7 Knots)

Conversion Factors:
1 In. Hg = 70.727 lb/sq. ft. = 0.4912 lb/sq. in.
1 Knot = 1.151 MPH = 1.688 ft/sec.

Altitude feet	Density Ratio $\sigma = P/P_0$	Smoe Factor $\frac{1}{\sqrt{\sigma}}$	Temperature Deg. C	Temperature Deg. F	Speed of Sound (Knots)	Pressure In. of Hg.	Pressure Ratio $\delta = P/P_0$
0	1.0000	1.0000	15.000	59.000	661.7	29.92	1.0000
1000	.9710	1.0148	13.019	55.434	659.5	28.86	.9644
2000	.9428	1.0299	11.038	51.868	657.2	27.82	.9298
3000	.9151	1.0454	9.056	48.301	654.9	26.81	.8962
4000	.8881	1.0611	7.075	44.735	652.6	25.84	.8636
5000	.8616	1.0773	5.094	41.169	650.3	24.89	.8320
6000	.8358	1.0938	3.113	37.603	647.9	23.98	.8013
7000	.8106	1.1107	1.132	34.037	645.6	23.09	.7716
8000	.7859	1.1280	-0.850	30.471	643.3	22.22	.7427
9000	.7619	1.1456	-2.831	26.904	640.9	21.38	.7147
10000	.7384	1.1637	-4.812	23.338	638.6	20.58	.6876
11000	.7154	1.1822	-6.793	19.772	636.2	19.79	.6614
12000	.6931	1.2012	-8.774	16.206	633.9	19.03	.6359
13000	.6712	1.2206	-10.756	12.640	631.5	18.29	.6112
14000	.6499	1.2404	-12.737	9.074	629.1	17.57	.5873
15000	.6291	1.2608	-14.718	5.507	626.7	16.88	.5642
16000	.6088	1.2816	-16.699	1.941	624.3	16.21	.5418
17000	.5891	1.3029	-18.680	-1.625	621.9	15.56	.5202
18000	.5698	1.3247	-20.662	-5.191	619.4	14.94	.4992
19000	.5509	1.3473	-22.643	-8.757	617.0	14.33	.4790
20000	.5327	1.3701	-24.624	-12.323	619.6	13.75	.4594
21000	.5148	1.3937	-26.605	-15.890	612.1	13.18	.4405
22000	.4974	1.4179	-28.586	-19.456	609.6	12.63	.4222
23000	.4805	1.4426	-30.568	-23.022	607.2	12.10	.4045
24000	.4640	1.4681	-32.549	-26.588	604.7	11.59	.3874
25000	.4480	1.4940	-34.530	-30.154	602.2	11.10	.3709
26000	.4323	1.5209	-36.511	-33.720	599.7	10.62	.3550
27000	.4171	1.5484	-38.493	-37.287	597.2	10.16	.3397
28000	.4023	1.5768	-40.474	-40.853	594.6	9.720	.3248
29000	.3879	1.6056	-42.455	-44.419	592.1	9.293	.3106
30000	.3740	1.6352	-44.436	-47.985	589.6	8.880	.2968
31000	.3603	1.6359	-46.417	-51.551	587.0	8.483	.2834
32000	.3472	1.6971	-48.399	-55.117	584.4	8.101	.2707
33000	.3343	1.7295	-50.379	-58.684	581.8	7.732	.2583
34000	.3218	1.7628	-52.361	-62.250	579.3	7.377	.2465
35000	.3098	1.7966	-54.342	-65.815	576.7	7.036	.2352

Figure A1-6

DRAG NUMBERS

STORE	TYPE	WEIGHT POUNDS	PYLON LOCATION L1-R1, L2-R2, L3-R3. NO ADJACENT STORE	L1-R1, L2-R2, L3-R3. ONE ADJACENT STORE	L1-R1, L2-R2, L3-R3. TWO ADJACENT STORES	L4-R4 NO ADJACENT STORE	L4-R4 ONE ADJACENT STORE
AN-M47A4	PWP,WP BOMB	130	16	16	16	15	16
AF/ B-37K-1	PRACTICE BOMB CONTAINER RACK WITH BDU-33/B, BDU-33A/B AND BDU-33B/B BOMB — FULL EMPTY	175 80	20	20	20	20	20
BLU-1C/B	FIRE BOMB	697	28	30	32		
BLU-23/B	FIRE BOMB	490	22	23	24		
BLU-27/B BLU-27A/B	FIRE BOMB	847	28	30	32		
BLU-32/B BLU-32A/B	FIRE BOMB	540	22	23	24		
BLU-52/B	CHEMICAL BOMB	350	28	30	32	30	32
CBU-14/A CBU-14A/A	DISPENSER & BOMB — FULL EMPTY	250 50	25	25	25	25	25
CBU-22/A CBU-22A/A	DISPENSER & BOMB — FULL EMPTY	226 50	25	25	25	25	25
CBU-24A/B CBU-24B/B CBU-29A/B CBU-29B/B CBU-49A/B CBU-49B/B CBU-53/B CBU-54/B	DISPENSER & BOMB	830	27	41	55		
CBU-52/B	DISPENSER & BOMB	739	27	41	55		
CBU-52A/B	DISPENSER & BOMB	788	27	41	55		
CBU-25/A CBU-25A/A	DISPENSER & BOMB — FULL EMPTY	264 50	25	25	25	25	25
LAU-3/A	ROCKET LAUNCHER	427	34	36	38		
LAU-3/A	ROCKET LAUNCHER EMPTY, NO FAIRINGS	71	78	78	78		
LAU-32A/A LAU-32B/A LAU-54/A LAU-59/A	ROCKET LAUNCHER	174 177 181 181	12	13	14	12	13
LAU-32A/A LAU-32B/A LAU-54/A LAU-59/A	ROCKET LAUNCHER EMPTY, NO FAIRINGS	47 50 54 54	31	31	31	31	31
M117 M117A1 M117A1E2 M117A1E3	GP BOMB	823	54	59	64		
M129E1	LEAFLET BOMBS	200	59	64	69		
MK-36	DESTRUCTOR	560	20	21	22		
MK-81	GP BOMB	260	11	12	13	11	12
MK-82	GP BOMB	531	20	21	22		
MK-82/M1A1	GP BOMB & FUZE EXTENDER	531	20	21	22		
MK-82 (SNAKEYE 1)	GP BOMB	560	27	30	32		
PYLON TANK	FUEL-100 GAL — FULL EMPTY	750 119	30	32	34		
SUU-11A/A	GUN POD — FULL EMPTY	325 245	8	8	8	8	8
SUU-25A/A	FLARE DISPENSER — FULL EMPTY	340 121	8	8	8	8	8
CBU-55/B	FAE BOMB CLUSTER	519					

Note

- CLEAN AIRCRAFT DRAG INDEX - 0. (GEAR AND FLAPS UP CONFIGURATION WITH TWO TIP TANKS, EIGHT PYLONS WITH BOMB RACKS, AERIAL REFUELING PROBE AND NOSE GUN INSTALLED.)
- ON AIRCRAFT WITHOUT AERIAL REFUELING PROBE INSTALLED, SUBTRACT 16 FROM THE TOTAL DRAG INDEX.
- DRAG NUMBERS AND PYLON LOCATIONS FOR THE CBU-55/B HAVE NOT BEEN ESTABLISHED.

Figure A1-7

PART II — TAKEOFF

TABLE OF CONTENTS

TAKEOFF AND LANDING CROSSWIND CHART.

The Takeoff and Landing Crosswind Chart (figure A2-1) is used to resolve the prevailing wind into headwind and crosswind components and to determine the minimum nose wheel lift-off and main gear touchdown speed for the crosswind component. The speed obtained from the chart is the lowest speed that a heading and course along the runway can be maintained with full rudder and ailerons deflected, when the nose wheel is off the runway. The recommended main gear touchdown speed is determined from the landing speed chart or the crosswind chart, whichever is greater.

USE.

Reduce the reported wind direction to a relative bearing by determining the difference between the wind direction and runway heading. Enter the chart with the relative bearing. Move along the relative bearing to intercept the wind speed arc corresponding to the reported steady wind velocity. From this point project horizontally to the left to read the headwind component. Next, move along the relative bearing to intercept the wind speed arc corresponding to the maximum gust velocity. From this intersection of bearing and wind speed, move vertically downward to read the crosswind component. If this intersection is in the "PRECAUTIONARY CROSSWIND TAKEOFF" area, project vertically to the guide line then horizontally to the right to obtain the minimum nose wheel lift-off and main gear touchdown speeds. If this intersection is in the "NOT RECOMMENDED CROSSWIND TAKEOFF" area, do not attempt a takeoff or landing.

Note

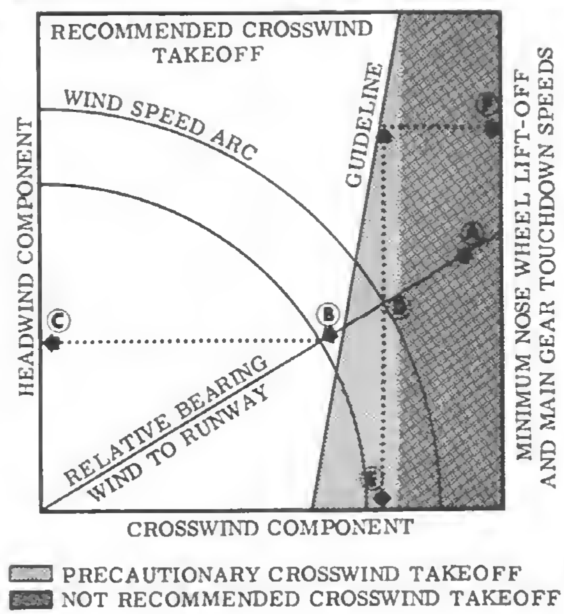
> The recommended main gear touchdown speed is determined from the landing speed chart or the crosswind chart, whichever is greater.

SAMPLE PROBLEM.

Given:
Reported wind 090/15 G20, runway heading 030.

A.	Relative bearing.	60°
B.	Using 15 knots, intersect wind speec arc.	
C.	Headwind component for takeoff distance determination.	7.5 Kts.
D.	Using 20 knots, intersect wind speed arc.	
E.	Crosswind component.	17.2 Kts.
F.	Minimum nose wheel lift-off speed and main gear touchdown speeds.	98 KIAS

SAMPLE TAKEOFF AND LANDING CROSSWIND CHART



TAKEOFF - OBSTACLE CLEARANCE SPEED.

The Takeoff - Obstacle Clearance Speed (figure A2-2) gives the indicated airspeed for takeoff and obstacle clearance as a function of gross weight.

DEFINITIONS.

TAKEOFF SPEED: Speed at which main gear lifts from runway.

OBSTACLE CLEARANCE SPEED. Speed necessary to obtain obstacle clearance distance.

USE.

Enter the Takeoff - Obstacle Clearance Speed (lower portion) with the gross weight and project vertically up to the appropriate flap condition curve. Project horizontally left and read the takeoff speed. To find the obstacle clearance speed, enter the upper portion with the gross weight and project vertically up to the appropriate flap condition curve. Project horizontally left and read the obstacle clearance speed.

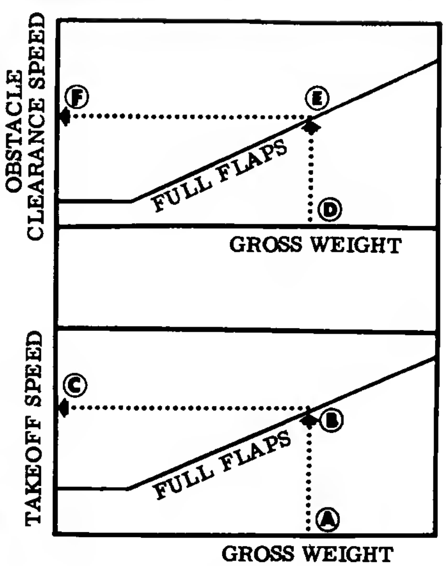
SAMPLE PROBLEM.

Given:
1. Gross weight = 12,000 lb.
2. Full flaps used.

Find takeoff and obstacle clearance speed:

A.	Gross weight	12,000 lb.
B.	Full flaps	
C.	Takeoff speed	115 KIAS
D.	Gross weight	12,000 lb.
E.	Full flaps	
F.	Obstacle clearance speed	125 KIAS

SAMPLE TAKEOFF-OBSTACLE CLEARANCE SPEED



TAKEOFF FACTOR CHART.

The Takeoff Factor Chart (figure A2-3) for maximum thrust and normal thrust (97.9% RPM) combines three of the factors affecting takeoff performance into one quantity, called takeoff factor. The three factors thus combined are air temperature, pressure altitude, and engine thrust setting. The effect of engine anti-ice and inlet screens may also be included in the takeoff factor, if required. In using the charts, the takeoff factor is determined for the particular conditions of the problem and then is used in the other charts to define takeoff distance, critical field length, and refusal speed.

USE.

Enter the chart with the air temperature and proceed horizontally right to the pressure altitude curve. At the point of intersection with the altitude curve, proceed vertically down to the desired thrust setting curve and then horizontally right to read the takeoff factor. If anti-ice or inlet screens are required, the appropriate thrust setting line is used.

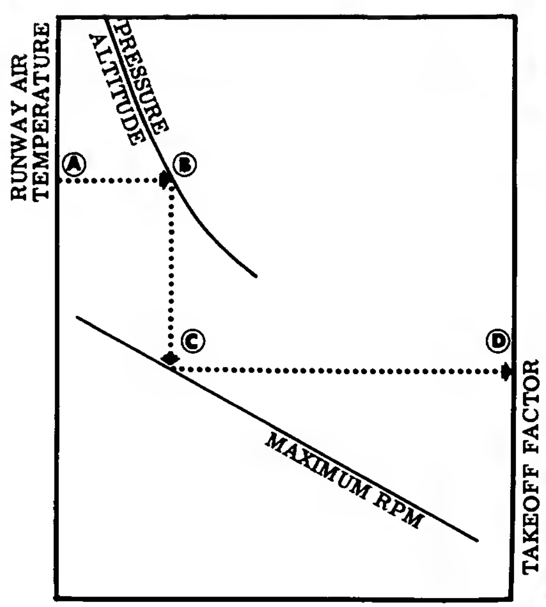
SAMPLE PROBLEM.

Given:
1. Runway temperature = 20°C.
2. Runway pressure altitude = 2000 ft.
3. Maximum thrust takeoff without screens or anti-ice.

Calculate takeoff factor for given conditions:

A.	Runway temperature	20°C
B.	Pressure altitude	2000 ft.
C.	Maximum thrust	
D.	Takeoff factor	2.5

SAMPLE TAKEOFF FACTOR CHART



TAKEOFF GROUND RUN DISTANCE.

Takeoff Ground Run Distance is presented in figure A2-4 as a function of the takeoff factors shown in

figure A2-3 for maximum thrust and normal thrust (97.9% RPM). Corrections are provided in the chart for wind and runway slope. There are three sheets to this chart, one for each of three flap settings (no, half and full). If recommended takeoff speed from figure A2-1 exceeds normal takeoff speed (figure A2-2), instructions for computing takeoff distance is covered under Velocity During Takeoff Ground Run, figure A2-9.

DEFINITIONS.

TAKEOFF GROUND DISTANCE: Ground run in feet from brake release to takeoff speed.

RUNWAY SLOPE: Expressed in percent (uphill or downhill), runway slope is the change in runway height divided by the runway length multiplied by 100.

USE.

Select the Takeoff Ground Run Distance (figure A2-4) appropriate to the flap setting used. Enter the chart with the takeoff factor determined from figure A2-3 and proceed horizontally to the right to the gross weight curve. At the point of intersection with the gross weight curve, proceed vertically down to the first base line. Follow the guidelines for headwind or tailwind to the wind velocity (if zero wind conditions prevail, proceed directly through) and continue vertically down to the second base line. Follow the runway slope guidelines for an uphill or downhill slope to the percent grade (if zero percent grade conditions prevail, proceed directly through). From this point, continue vertically down and read the ground run distance.

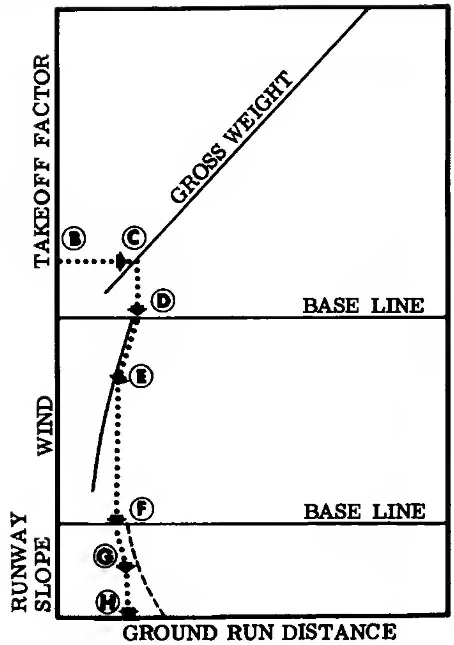
SAMPLE PROBLEM.

Given:
1. Full flaps
2. Takeoff factor = 2.5
3. Gross weight = 12,000 lb.
4. Headwind = 10 knots
5. Runway slope = 1% uphill

Calculate ground run for given conditions:

A.	Use figure A2-4 (sheet 3 of 3)	
B.	Takeoff factor	2.5
C.	Gross weight	12,000 lb.
D.	Base line	
E.	Wind	10 Kts.
F.	Runway slope base line	
G.	Runway slope	1% uphill
H.	Corrected ground run	1600 ft.

SAMPLE TAKEOFF GROUND RUN DISTANCE



TOTAL OBSTACLE CLEARANCE DISTANCE.

Total Obstacle Clearance Distance is presented in figure A2-5 as a function of the no wind ground distance determined from figure A2-4 and the obstacle height. Corrections are provided in the chart for wind. There are three sheets to this chart, one for each of three flap settings (no, half and full).

DEFINITIONS.

OBSTACLE CLEARANCE DISTANCE: Horizontal distance from brake release to the obstacle.

USE.

Select the Total Obstacle Clearance Distance appropriate to the flap setting used. Enter the chart with the obstacle height and proceed vertically upward to the ground run (zero wind) obtained from figure A2-4. This ground run value should be corrected for runway slope, if required, but should contain no wind correction. From this point of intersection, proceed horizontally right to the base line and follow the guidelines to the appropriate headwind or tailwind, if necessary, and then horizontally right to read the total clearance distance required.

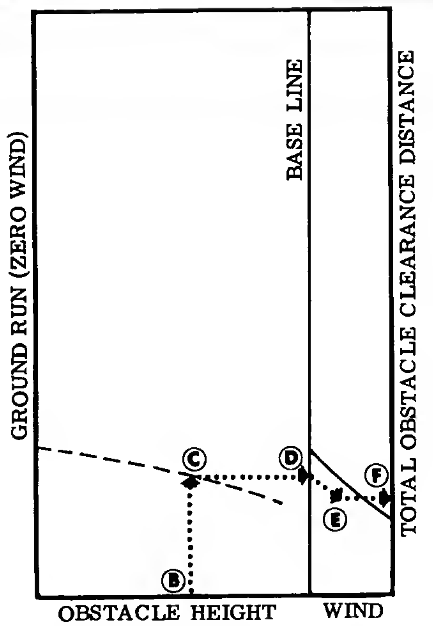
SAMPLE PROBLEM.

Given:
1. Full flaps
2. Obstacle height to be cleared is 100 ft.
3. Takeoff ground run distance with a takeoff factor of 2.5, gross weight of 12,000 lb., zero wind and runway slope of 1% uphill (from figure A2-4, sheet 3 of 3) is 1900 ft.
4. Headwind = 10 knots

Calculate total obstacle clearance distance for given conditions:

A.	Use figure A2-5, sheet 3 of 3	
B.	Obstacle height	100 ft.
C.	Ground run (zero wind)	1900 ft.
D.	Base line	
E.	Headwind	10 Kts.
F.	Total obstacle clearance distance	2600 ft.

SAMPLE TOTAL OBSTACLE CLEARANCE DISTANCE



CRITICAL FIELD LENGTH.

Critical Field Length is presented in figure A2-6 as a function of takeoff factor and gross weight. Corrections are provided for runway condition and surface wind. There are three sheets, one for each of three flap settings (no, half and full).

DEFINITION.

CRITICAL FIELD LENGTH: Total distance required for the aircraft to accelerate on both engines to the critical engine failure speed, experience an engine failure, and then either continue the takeoff or stop. The chart assumes a three-second delay for reaction time and the use of normal braking with idle rpm.

RUNWAY CONDITION READING: A number that indicates the degree of braking friction available on the runway surface (obtainable from base operations).

USE.

Enter the appropriate Critical Field Length with the takeoff factor, proceed horizontally right to gross weight and then vertically down to the RCR line. From this point of intersection, proceed horizontally to the right to the base line and follow the guidelines to the appropriate headwind or tailwind, and then horizontally right to read the critical field length.

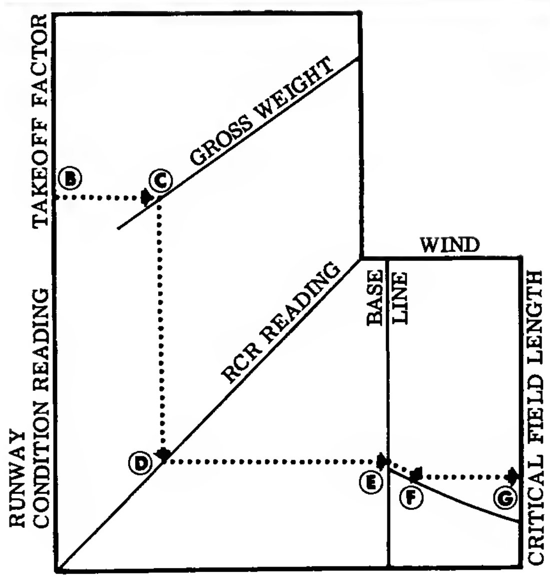
SAMPLE PROBLEM:

Given:
1. Full Flaps
2. Takeoff factor = 2.5
3. Gross weight = 12,000 lb.
4. RCR = dry (23)
5. Headwind = 10 knots

Calculate critical field length for given conditions:

A.	Use figure A2-6 (sheet 3 of 3)	
B.	Takeoff factor	2.5
C.	Gross weight	12,000 lb.
D.	RCR	dry (23)
E.	Base line	
F.	Headwind	10 Kts.
G.	Critical field length	3750 ft.

SAMPLE CRITICAL FIELD LENGTH



REFUSAL SPEED.

Refusal speed is presented in figure A2-7 as a function of takeoff factor, gross weight, and field length. Corrections are provided on the chart for surface

wind and airspeed position error. This includes a three-second delay for reaction time. The stopping distance for figure A2-7 is based on a dry, hard surface runway and idle rpm. For wet or icy conditions the stopping distance is increased and the corrected refusal speed is obtained from figure A2-8.

The correction to refusal speed for RCR values other than 23 is presented in figure A2-8 as a function of dry runway refusal speed and the runway condition reading.

DEFINITION.

REFUSAL SPEED: Maximum speed to which an aircraft can accelerate and then stop in the remaining runway length.

USE.

Enter the Refual Speed (figure A2-7) with the takeoff factor and project vertically up to the proper gross weight curve. From the gross weight intersection, project horizontally to the right to the appropriate runway length curve, then vertically down to the base line. From the base line, follow parallel to the guidelines for either a headwind or tailwind, to the proper wind velocity, then vertically down to the appropriate flap setting. From the flap setting intersection, project horizontally to the left and read refusal speed for a dry runway, RCR - 23.

To correct the refusal speed for other RCR values, use figure A2-8. Enter with the dry runway refusal speed (RCR - 23) and proceed vertically up to the proper RCR value, and then project horizontally to the left and read the corrected refusal speed.

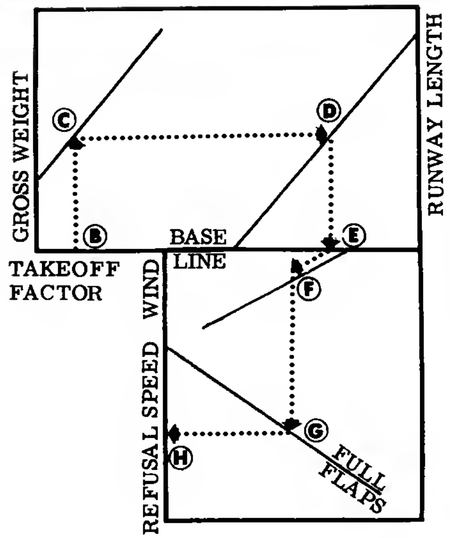
SAMPLE PROBLEM.

Given:
1. Takeoff factor = 2. 5
2. Gross weight = 12, 000 lb.
3. Runway length = 5000 ft.
4. Headwind = 10 knots
5. Full flaps
6. RCR = 12

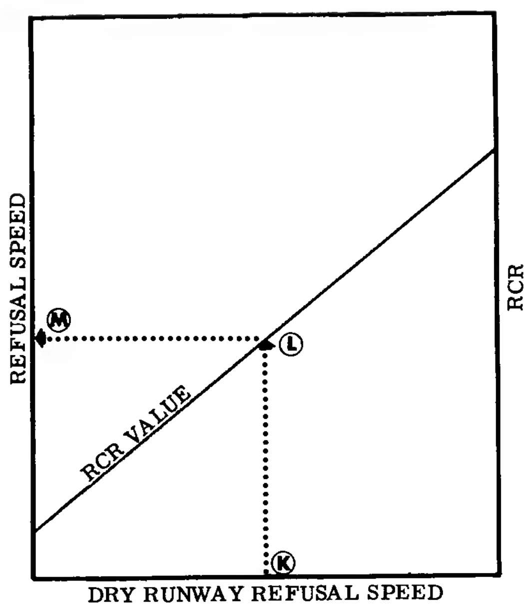
Calculate refusal speed for the given conditions:

A.	Use figure A2-7.	
B.	Takeoff factor	2. 5
C.	Gross weight	12, 000 lb.
D.	Runway length	5, 000 ft.
E.	Base line	
F.	Headwind	10 Kts.
G.	Flap condition	Full
H.	Refusal speed	89 KIAS
J.	Use figure A2-8	
K.	Dry runway refusal speed	89 KIAS
L.	RCR	12
M.	Corrected refusal speed	78 KIAS

SAMPLE REFUSAL SPEED



SAMPLE CORRECTION TO REFUSAL SPEED FOR RCR



VELOCITY DURING TAKEOFF GROUND RUN.

The Velocity During Takeoff Ground Run Chart (figure A2-9) is used to monitor the aircraft speed at fixed points along the runway during the takeoff ground run. The normal speed at any point along the runway may be determined by first determining the distance required to attain the normal takeoff speed for prevailing conditions and following the guidelines to tne fixed point distance.

USE.

Enter the chart with the takeoff ground distance (figure A2-4), proceed horizontally right to the normal takeoff speed (figure A2-2) line. Follow the guidelines down and to the left to the ground distance to the checkpoint. From this point descend vertically to find the velocity at the checkpoint.

If the recommended takeoff speed (figure A2-1) exceeds the normal takeoff speed (figure A2-2), enter the chart (figure A2-9) with the normal takeoff distance. Proceed horizontally to the normal takeoff speed line, then up and to the right on the guidelines until intersecting the recommended takeoff speed. Proceed horizontally to the left to find the takeoff distance.

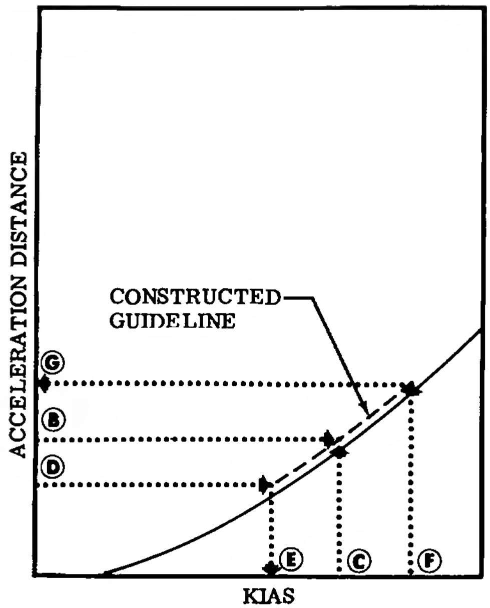
SAMPLE PROBLEM.

Given:
1. Normal takeoff ground run (figure A2-4) = 1600 ft.
2. Normal takeoff speed (figure A2-2) = 115 KIAS
3. Distance to checkpoint = 800 ft.
4. Recommended takeoff speed (figure A2-1) = 100 KIAS

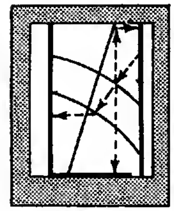
Calculate velocity at the checkpoint and the actual ground run:

A.	Use figure A2-9	
B.	Normal takeoff ground run	1600 ft.
C.	Normal takeoff speed	115 KIAS
D.	Distance to checkpoint	800 ft.
E.	Speed at checkpoint	81 KIAS
F.	Recommended takeoff speed	125 KIAS
G.	Takeoff distance	1890 ft.

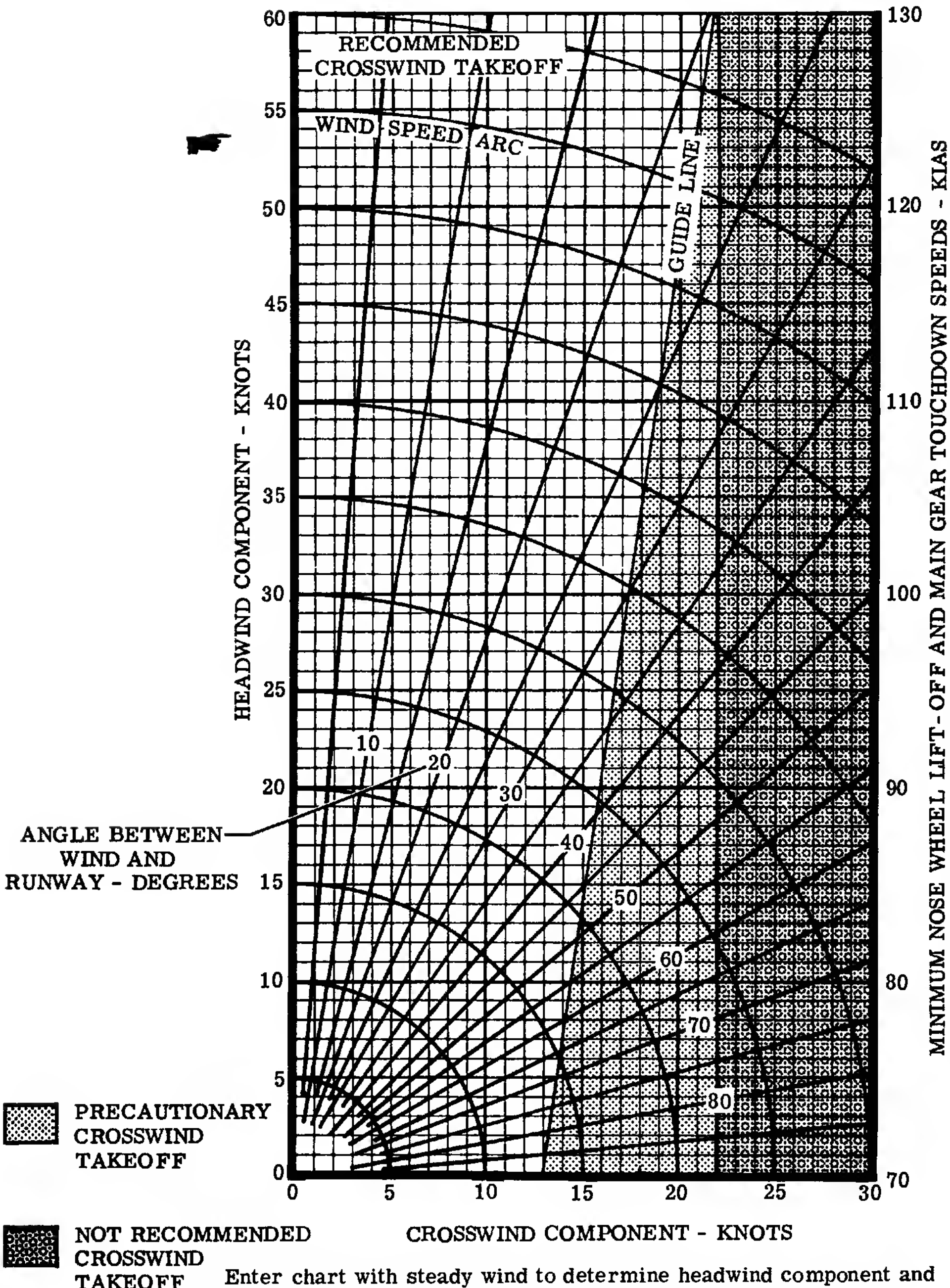
SAMPLE VELOCITY DURING TAKEOFF GROUND RUN CHART



TAKEOFF AND LANDING CROSSWIND CHART



ALL FLAP SETTINGS
MAXIMUM (FULL RUDDER DEFLECTION) SIDESLIP



Enter chart with steady wind to determine headwind component and with maximum gust velocity to determine crosswind component.

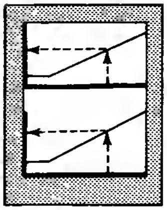
Figure A2-1

TAKEOFF - OBSTACLE CLEARANCE SPEED

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

MAXIMUM THRUST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



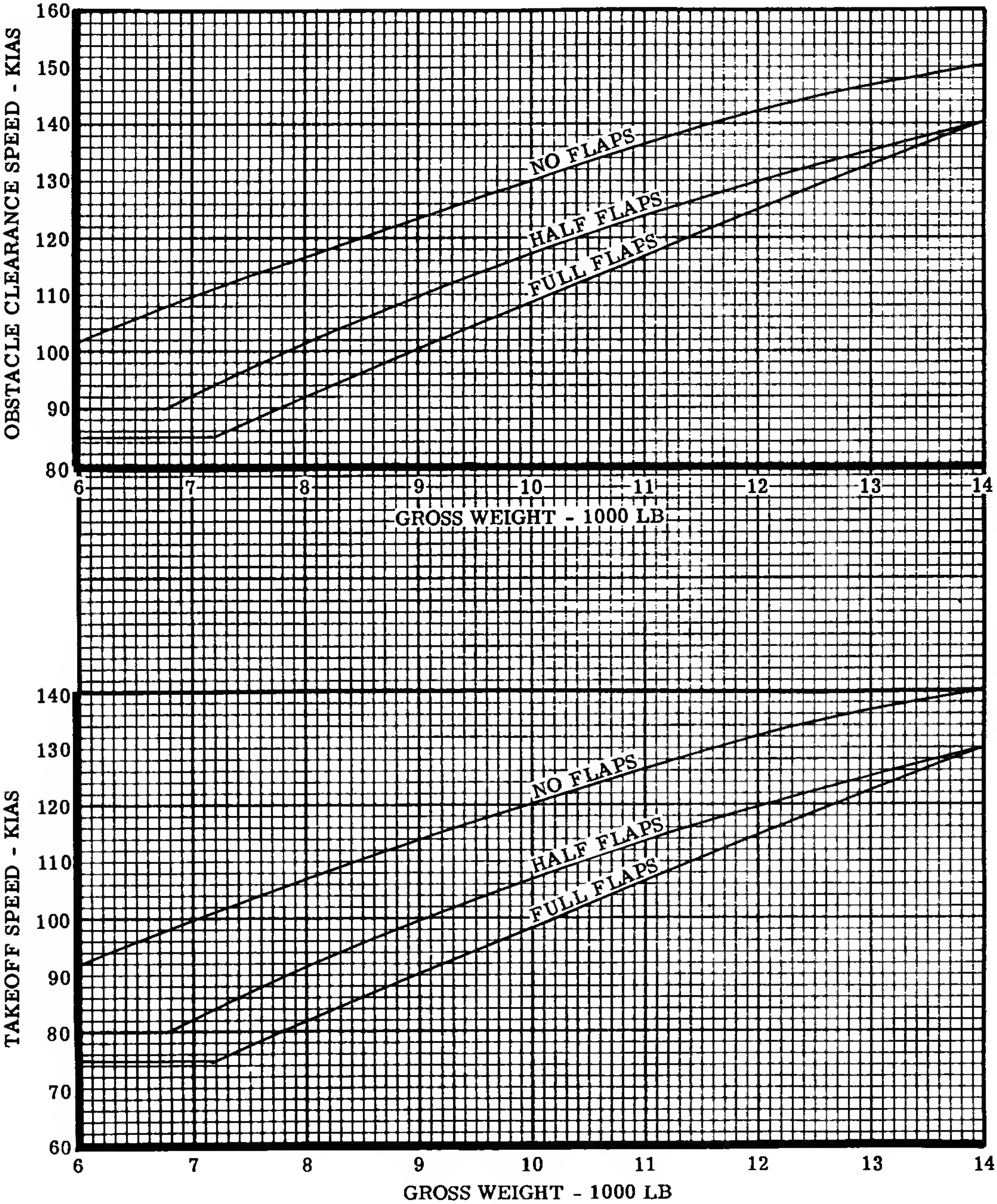
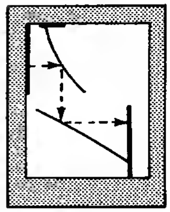


Figure A2-2

TAKEOFF FACTOR CHART

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



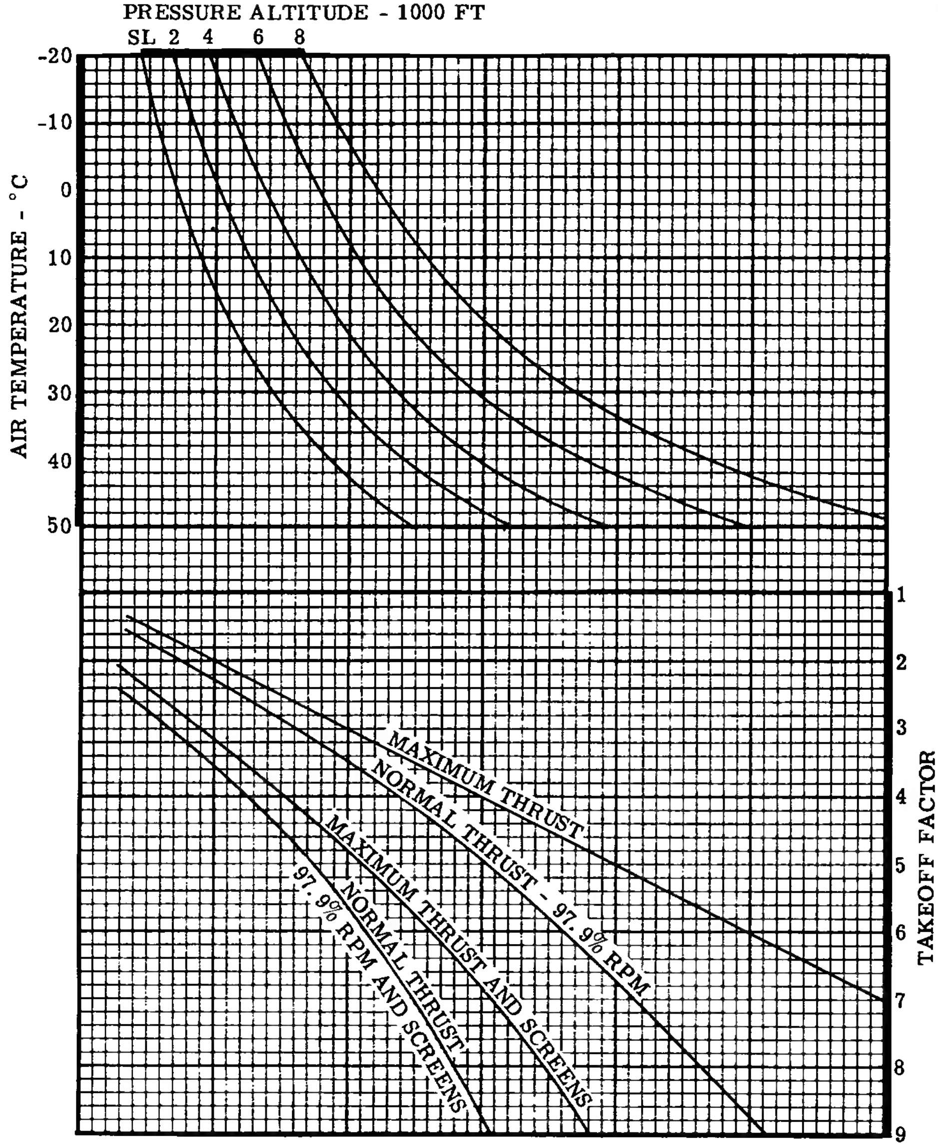


Figure A2-3

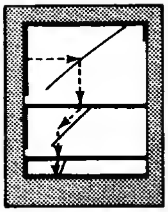
TAKEOFF GROUND RUN DISTANCE

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

DRY, HARD-SURFACE RUNWAY

NO FLAPS

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



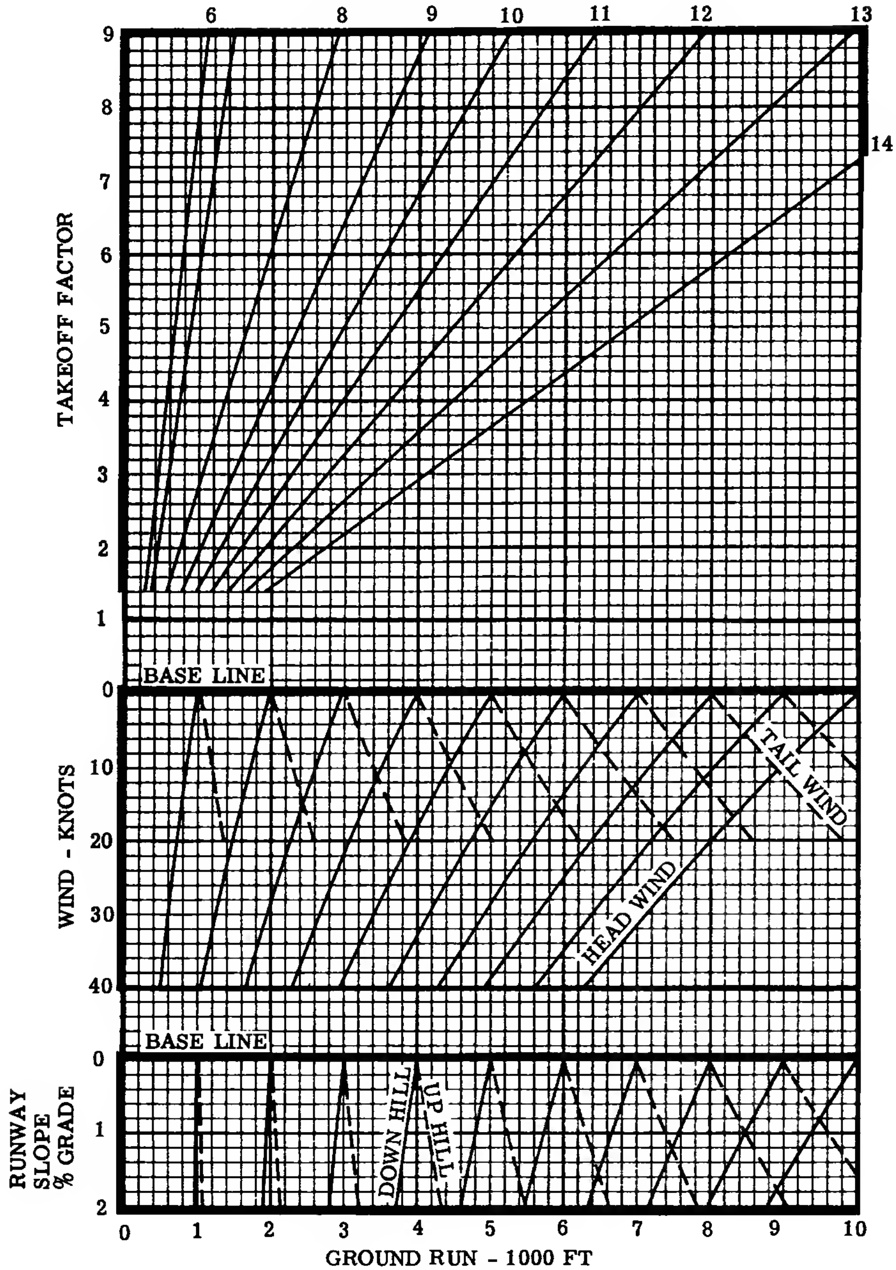


Figure A2-4. (Sheet 1 of 3)

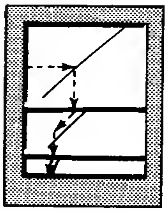
TAKEOFF GROUND RUN DISTANCE

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

DRY, HARD SURFACE RUNWAY

HALF FLAPS



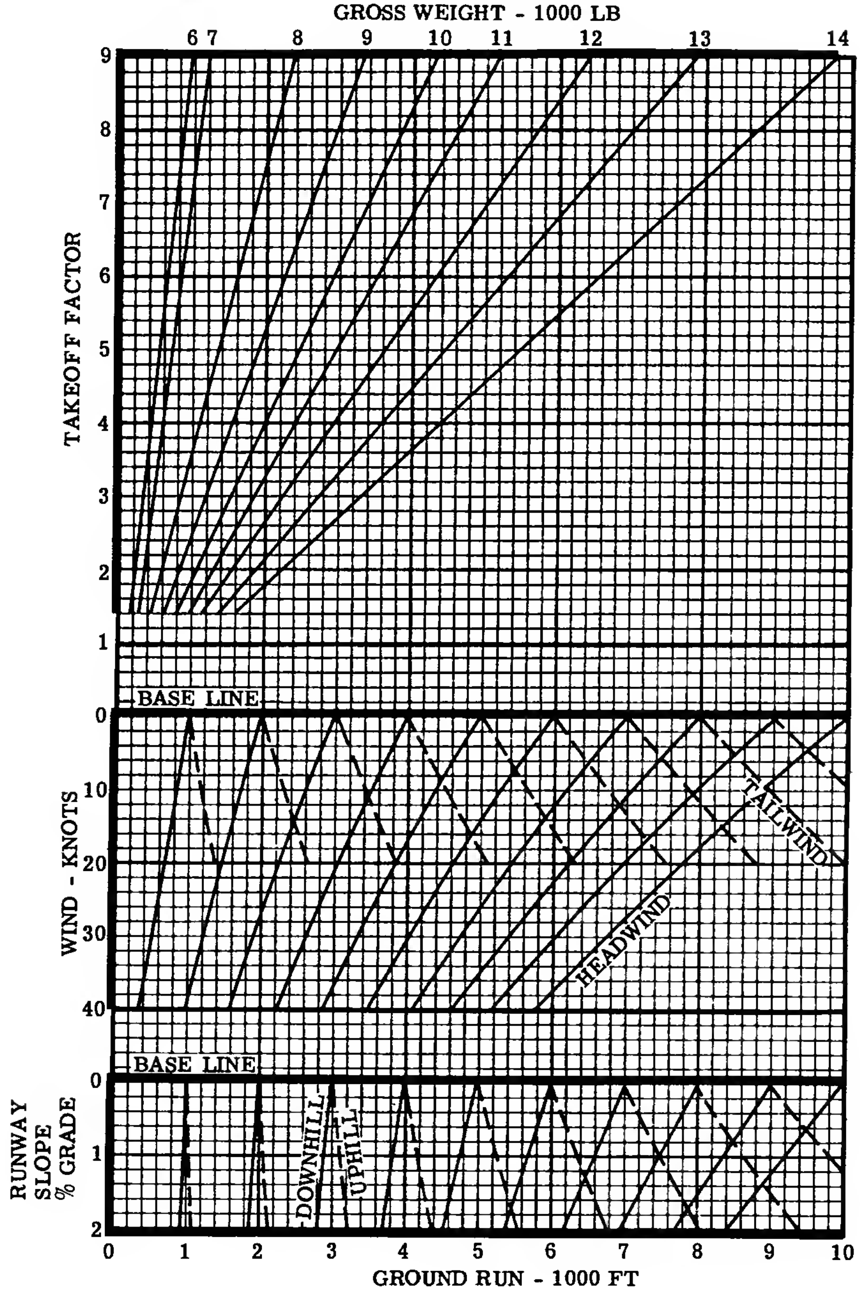


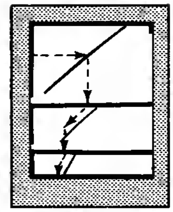
Figure A2-4 (Sheet 2 of 3)

TAKEOFF GROUND RUN DISTANCE

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

DRY, HARD SURFACE RUNWAY

FULL FLAPS



STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

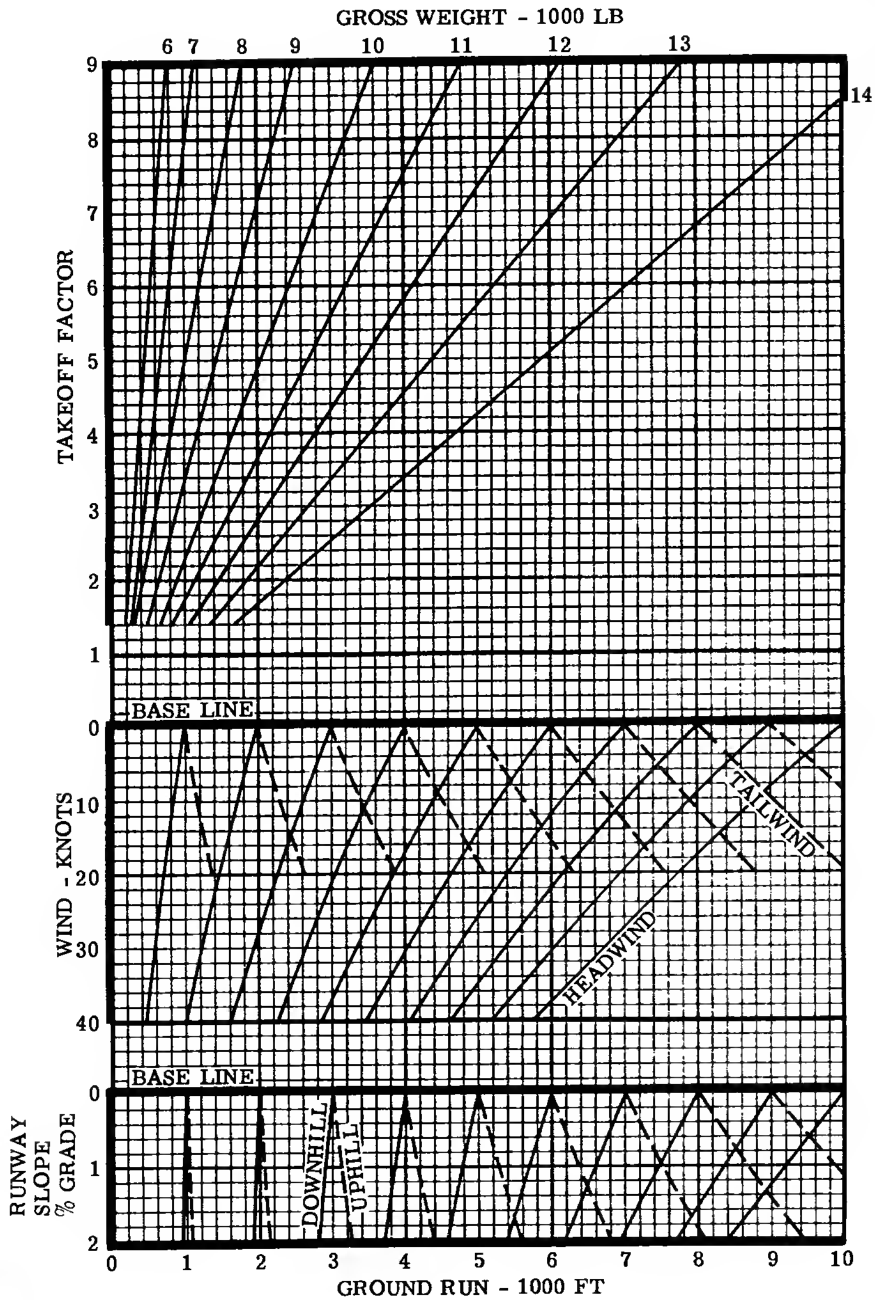


Figure A2-4 (Sheet 3 of 3)

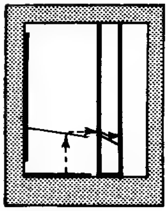
TOTAL OBSTACLE CLEARANCE DISTANCE

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

MAXIMUM THRUST

NO FLAPS



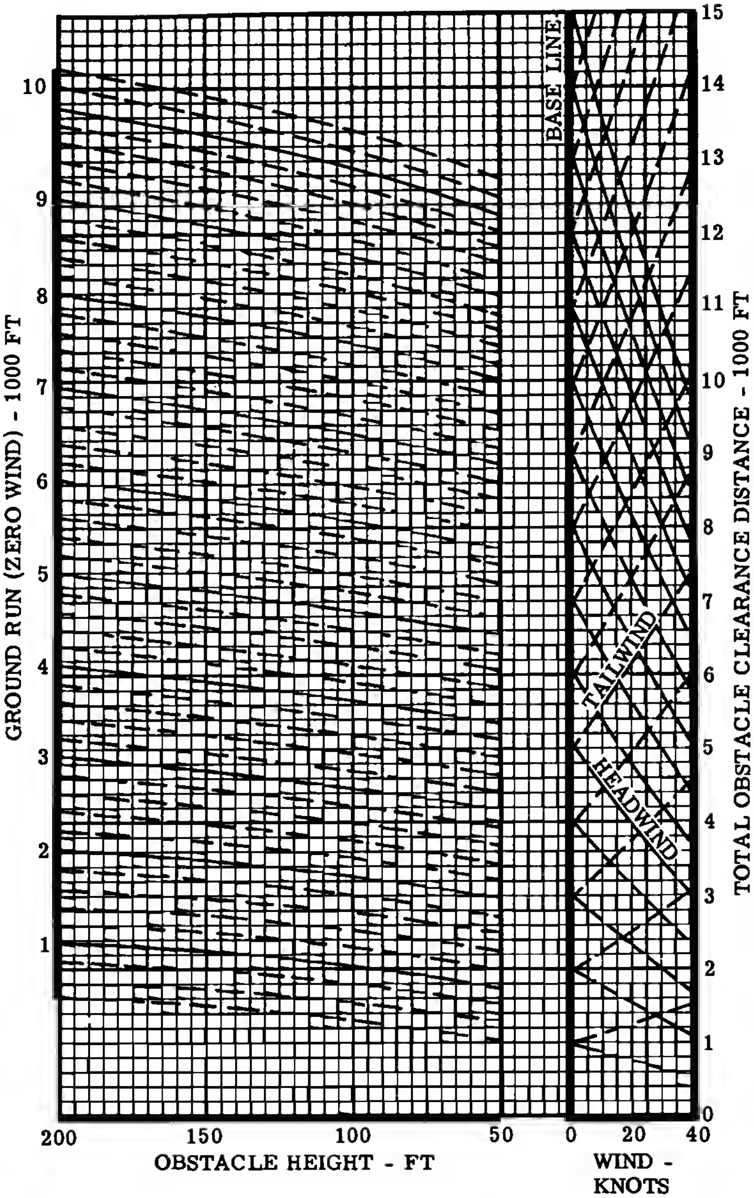


Figure A2-5 (Sheet 1 of 3)

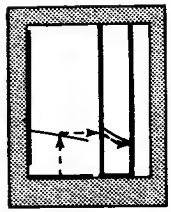
TOTAL OBSTACLE CLEARANCE DISTANCE

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

MAXIMUM THRUST

HALF FLAPS



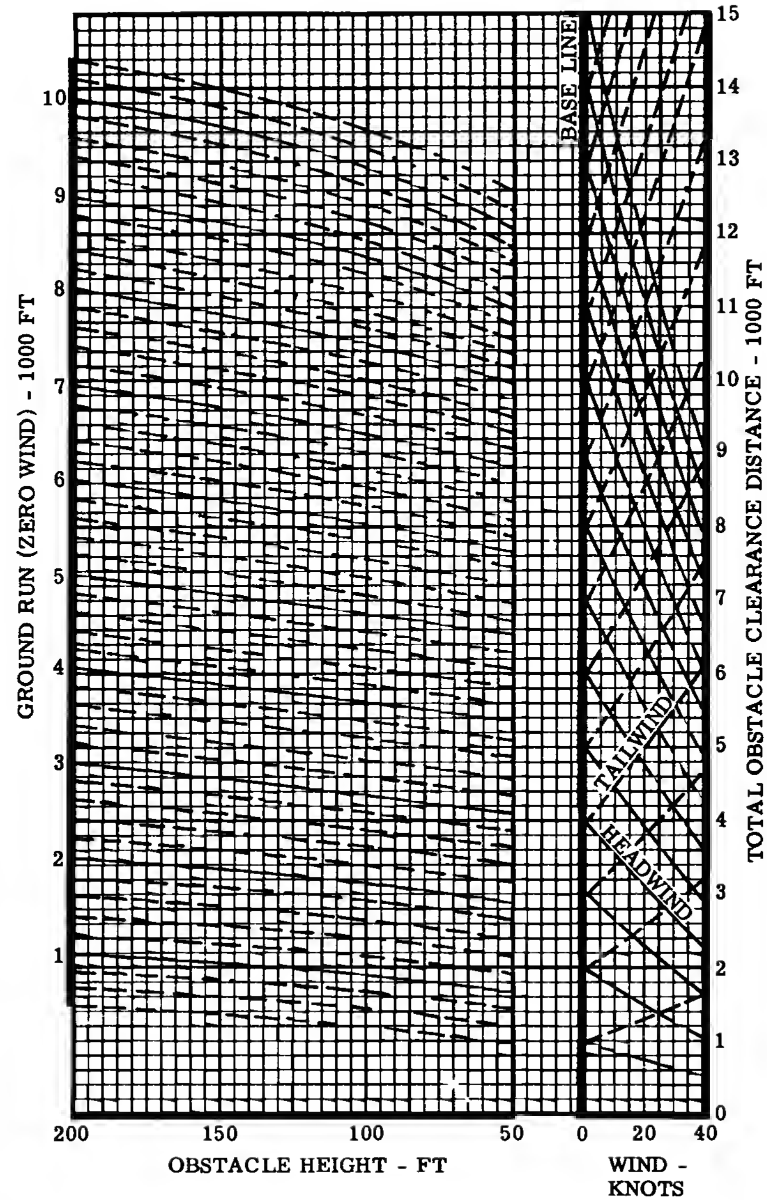


Figure A2-5 (Sheet 2 of 3)

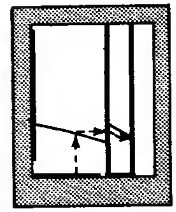
TOTAL OBSTACLE CLEARANCE DISTANCE

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

MAXIMUM THRUST

FULL FLAPS

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



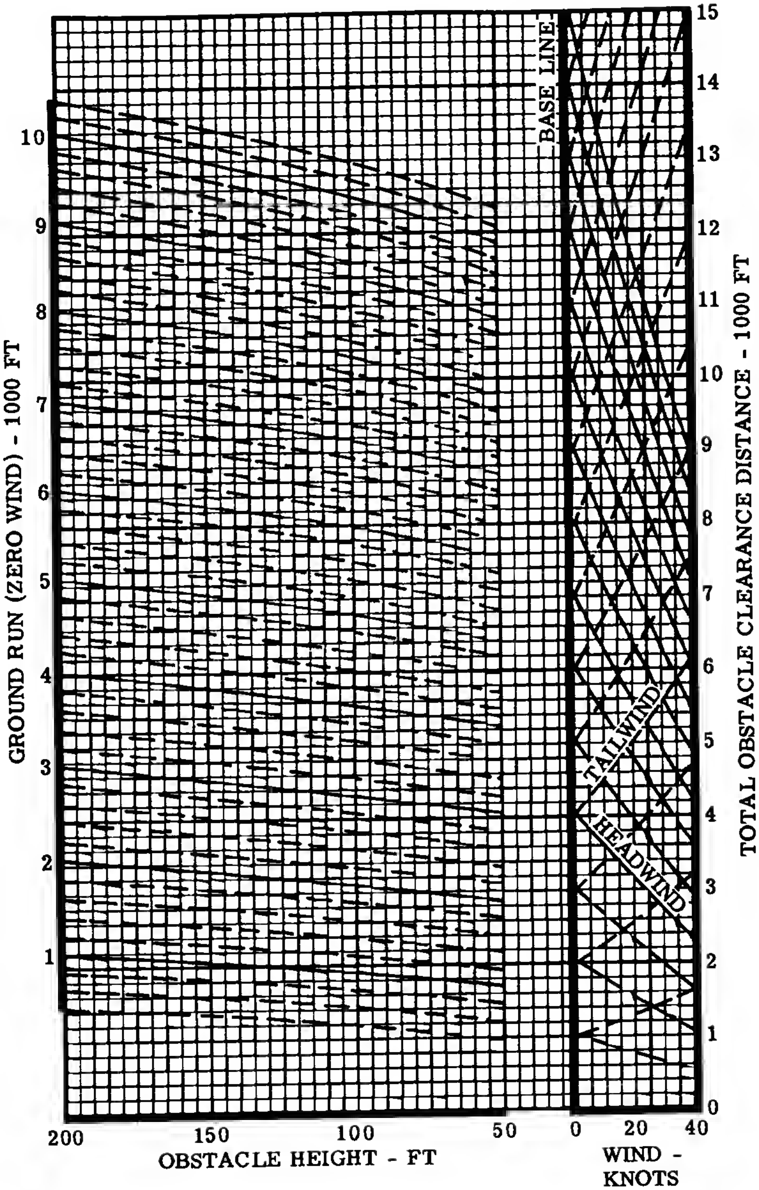


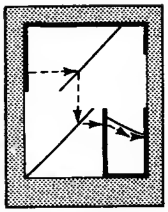
Figure A2-5 (Sheet 3 of 3)

CRITICAL FIELD LENGTH

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

NO FLAPS



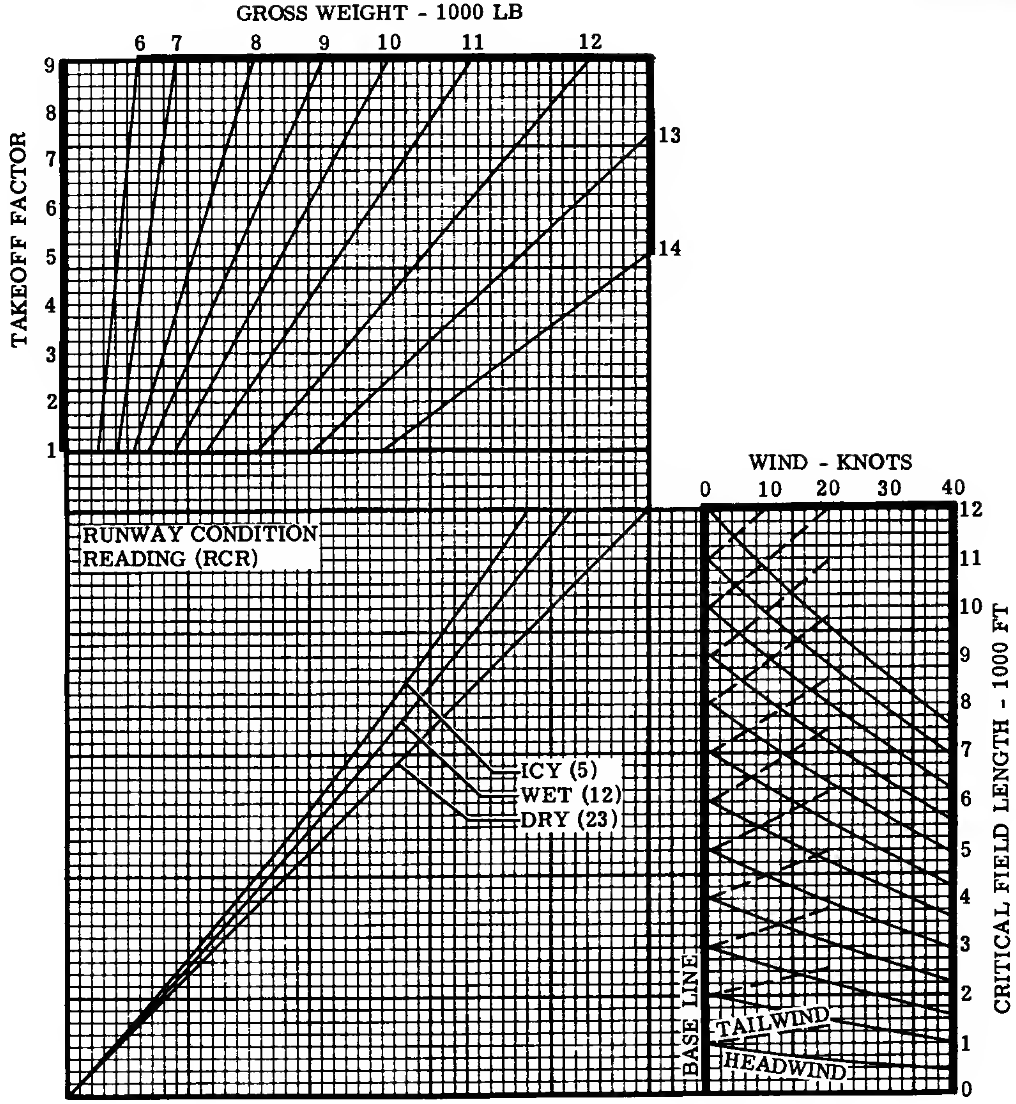


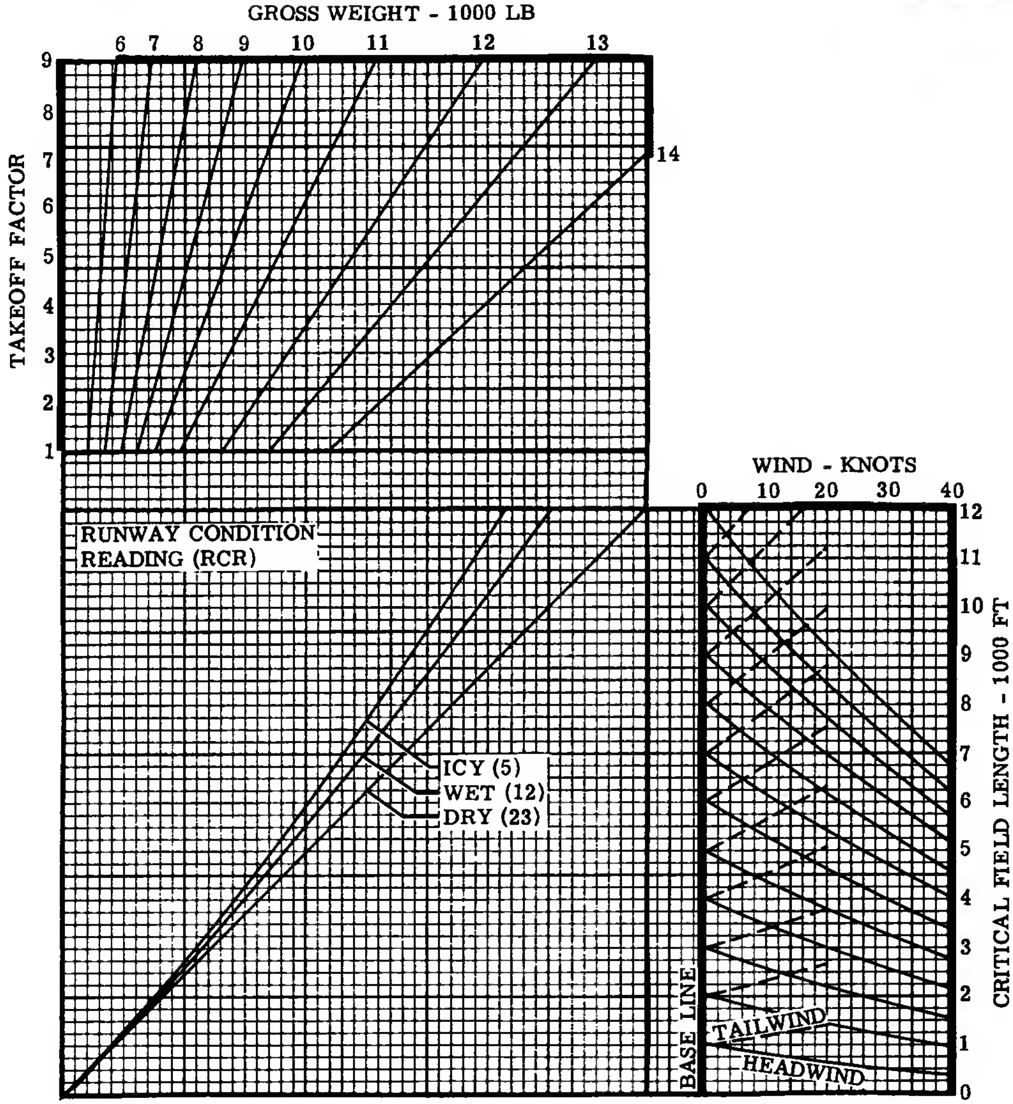
Figure A2-6 (Sheet 1 of 3)

CRITICAL FIELD LENGTH

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

HALF FLAPS

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



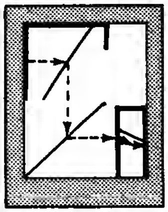


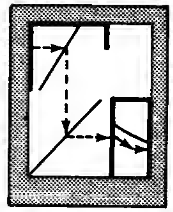
Figure A2-6 (Sheet 2 of 3)

CRITICAL FIELD LENGTH

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

FULL FLAPS



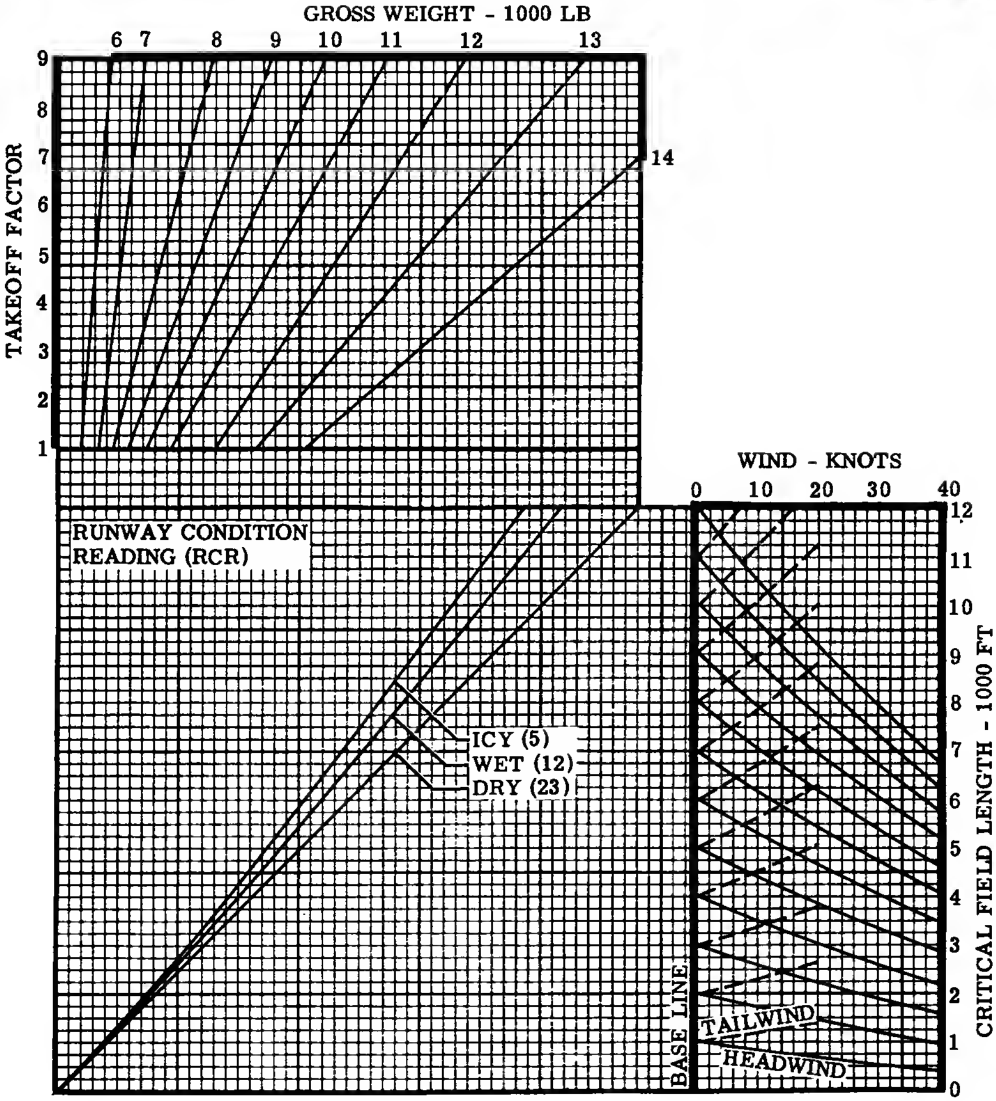
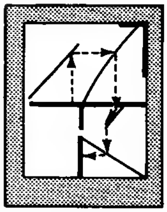


Figure A2-6 (Sheet 3 of 3)

REFUSAL SPEED

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



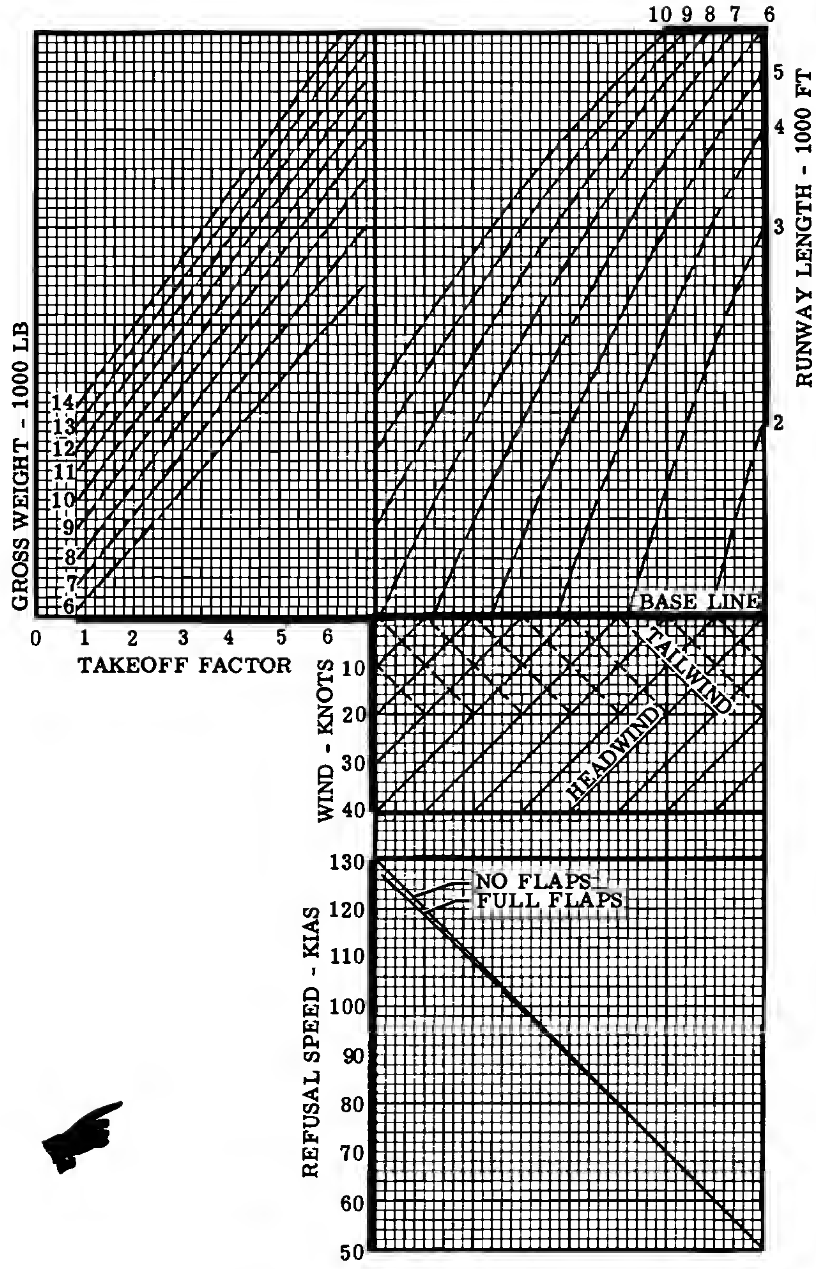
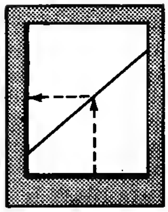


Figure A2-7

CORRECTION TO REFUSAL SPEED FOR RCR

ALL FLAP SETTINGS



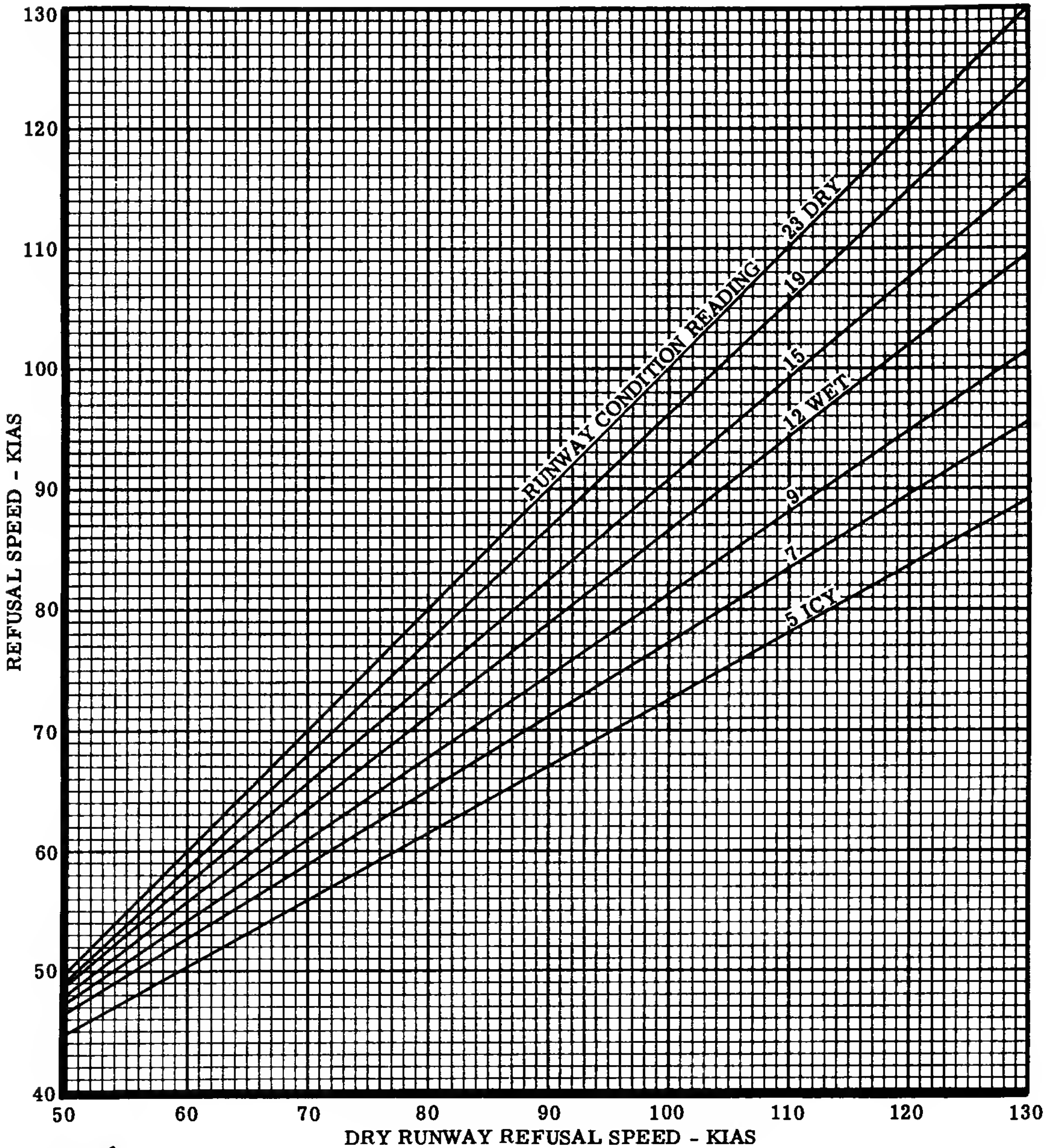
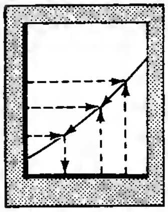


Figure A2-8

VELOCITY DURING TAKEOFF GROUND RUN

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



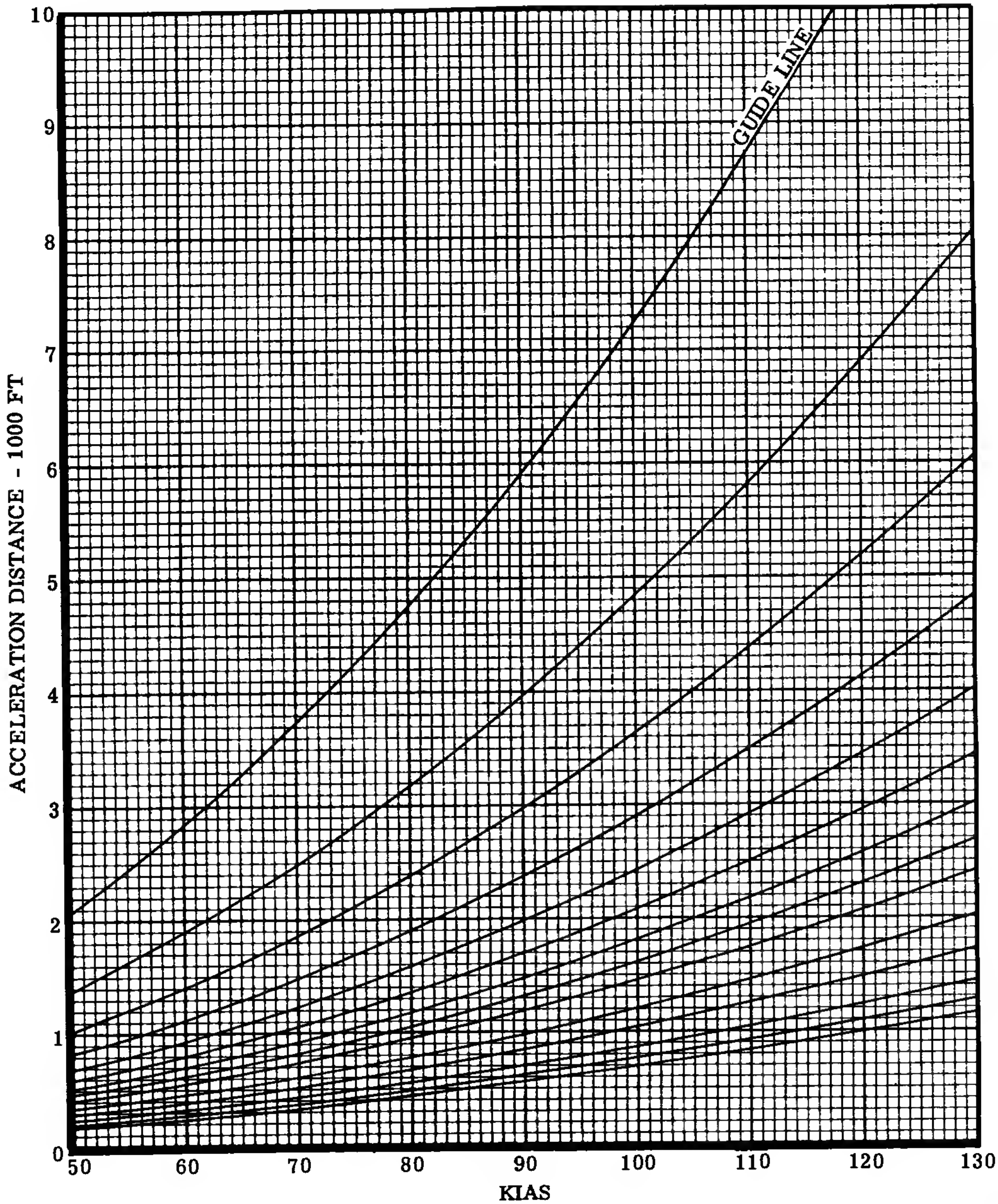


Figure A2-9

PART III — CLIMB

TABLE OF CONTENTS

CLIMB PERFORMANCE.

Climb performance (Figure A3-1 through A3-3) is presented for three climb thrust conditions, one and two engine maximum thrust and two engine normal thrust (97.9% RPM) climb. Each series includes data for determining time, distance covered and fuel used while in climb and a table for determining calibrated airspeed. Preclimb requirement is that 300 pounds of fuel be deducted from the initial gross weight to account for engine start, taxi, takeoff and accelerate to climb speed.

USE.

Enter the Climb Speed Schedule (figure A3-1) corresponding to the climb thrust, configuration drag index and altitude and read the knots calibrated airspeed for these conditions.

The method of presenting the Fuel Used to Climb and the Time to Climb and Horizontal Distance Traveled During Climb data is identical for all three climb thrust conditions. Their use will be undertaken simultaneously here. Enter the Fuel Used to Climb (figure A3-2) with the initial climb gross weight (initial gross weight minus 300 pounds) and proceed horizontally to the right to the desired pressure altitude. Project vertically downward to the appropriate drag index, then horizontally to the right to the base line. The base line represents ICAO standard day conditions. From the base line, follow parallel to the guidelines (hotter or colder than standard day) to the proper temperature difference (Δ temp -°C) and project horizontally to the right and read the pounds of fuel used. Enter the Time to Climb and Horizontal Distance Traveled During Climb (figure A3-3) with the initial climb gross weight (initial gross weight minus 300 pounds) and proceed horizontally to the right to the proper pressure altitude. Project vertically downward to the appropriate drag index in the first set of drag index reflectors, then horizontally to the right to the base line. From the base line, follow parallel to the guidelines (hotter or colder than standard day) to the proper temperature difference (Δ temp -°C) and project horizontally to the right and read the time required to climb. To determine the horizontal distance traveled, continue downward from the first drag index intersection to the appropriate drag index in the second set of drag index reflectors. Then move horizontally to the right to the base line. From the base line, follow parallel to the guidelines (hotter or colder than standard day) to the proper temperature difference (Δ temp -°C) and project horizontally to the right and read the horizontally distance in nautical miles covered during climb.

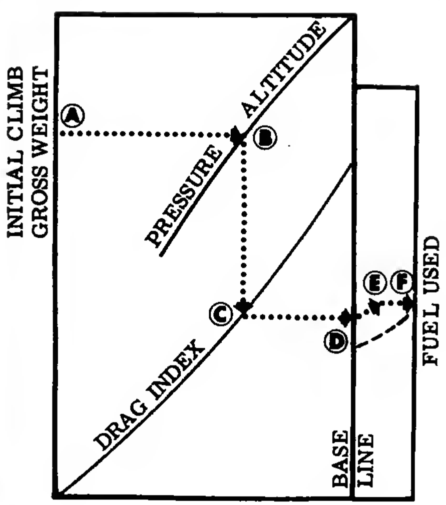
SAMPLE PROBLEM.

Given:
1. Maximum thrust, two engine climb
2. Initial gross weight = 10,800 lbs.
3. Configuration drag index = 300
4. Pressure altitude = 25,000 ft.
5. Temperature difference = 10°C hotter

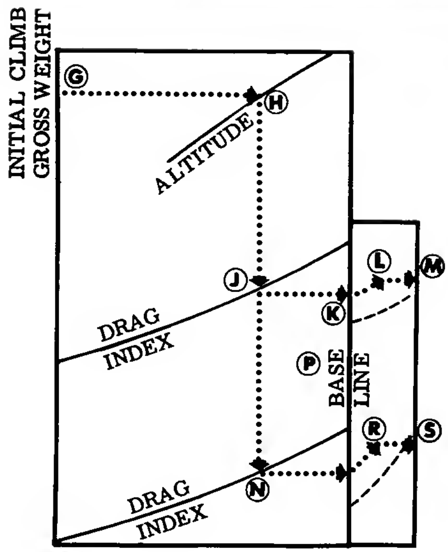
Find:
1. Time, distance, and fuel used to climb to 25,000 ft.

A.	Initial climb gross weight (figure A3-2) (10,800 -300)	10,500 lb.
B.	Pressure altitude	25,000 ft.
C.	Drag index	300
D.	Base line	
E.	Temperature difference	10°C, hotter
F.	Fuel used to climb	440 lb.
G.	Initial climb gross weight (figure A3-3) (10,800 -300)	10,500 lb.
H.	Pressure altitude	25,000 ft.
J.	Drag line	300
K.	Base line	
L.	Temperature difference	10°C hotter
M.	Time to climb	6.2 min
N.	Drag index	300
P.	Base line	
R.	Temperature difference	10°C hotter
S.	Distance covered in climb	24.5 N mi.

SAMPLE FUEL USED TO CLIMB CHART



SAMPLE TIME TO CLIMB AND HORIZONTAL DISTANCE TRAVELED DURING CLIMB



CLIMB SPEED SCHEDULE

STANDARD DAY

MAXIMUM THRUST - TWO ENGINES

ALTITUDE - FEET	DRAG INDEX					
	0	100	200	300	400	500
	KCAS	KCAS	KCAS	KCAS	KCAS	KCAS
SL	253	241	230	220	211	202
5000	240	228	219	209	201	193
10,000	227	216	207	199	191	184
15,000	214	204	196	187	182	175
20,000	201	192	185	178	172	166
25,000	188	179	173	168	162	157

NORMAL THRUST (97.9% RPM) - TWO ENGINES

ALTITUDE - FEET	DRAG INDEX					
	0	100	200	300	400	500
	KCAS	KCAS	KCAS	KCAS	KCAS	KCAS
SL	243	230	219	210	202	194
5000	232	219	209	201	193	185
10,000	220	208	199	191	184	177
15,000	208	197	188	181	175	169
20,000	196	186	178	172	166	160
25,000	185	175	168	162	157	152

MAXIMUM THRUST - SINGLE ENGINE

ALTITUDE -FEET	DRAG INDEX					
	0	100	200	300	400	500
	KCAS	KCAS	KCAS	KCAS	KCAS	KCAS
SL	196	188	179	170	163	156
5000	186	178	170	162	155	149
10,000	176	169	161	154	148	142
15,000	167	159	152	146	141	135
20,000	157	150	143	138	133	128
25,000	147	140	134	130	126	121

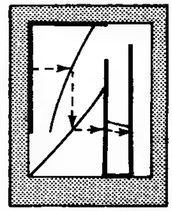
Figure A3-1

FUEL USED TO CLIMB

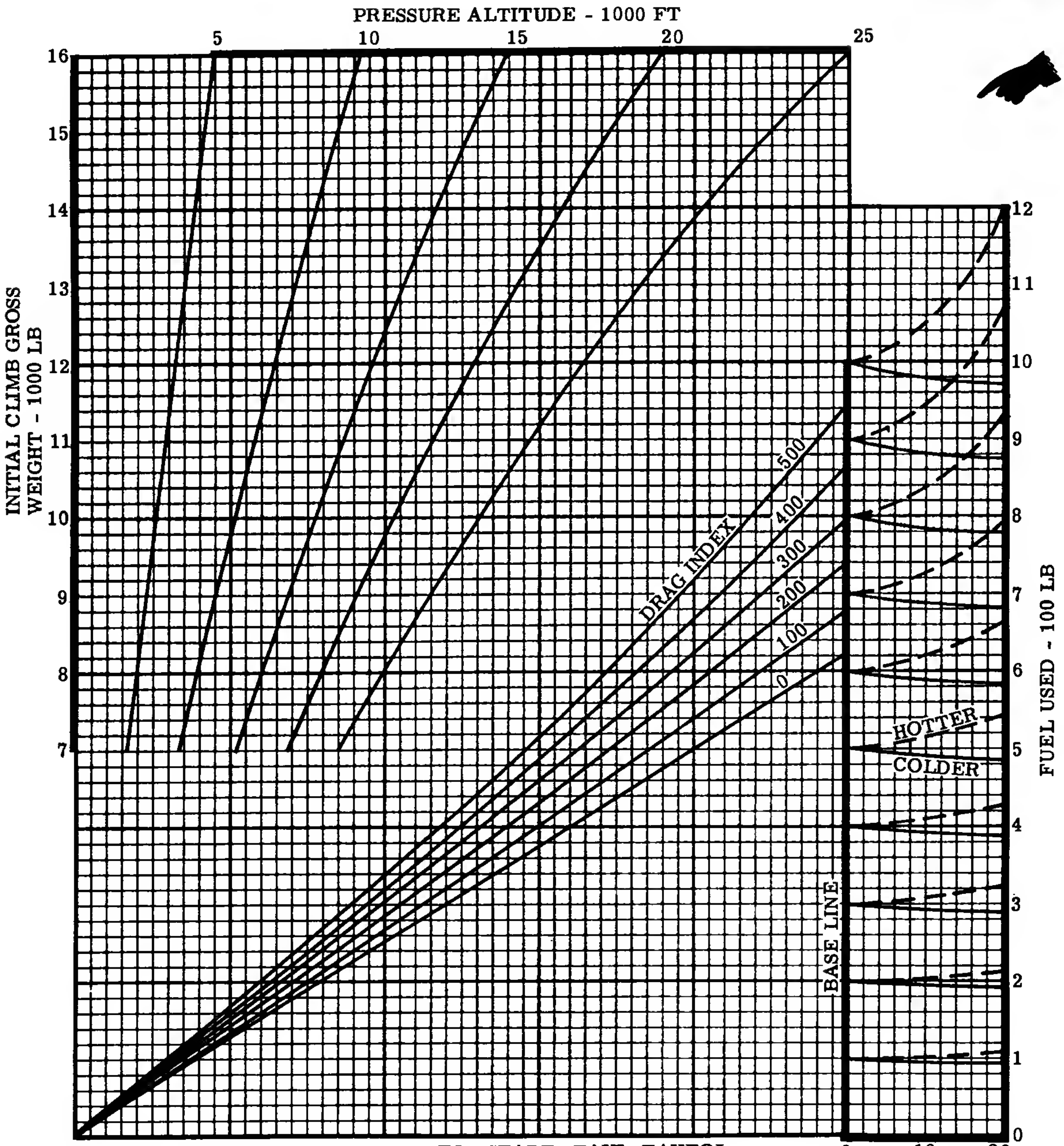
MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

TWO ENGINES

MAXIMUM THRUST



STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



NOTE: ALLOW 300 POUNDS FUEL FOR START, TAXI, TAKEOF AND ACCELERATION TO TAKEOFF CLIMB SPEED.

Figure A3-2 (Sheet 1 of 3)

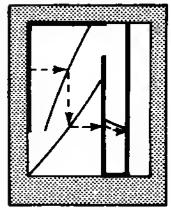
FUEL USED TO CLIMB

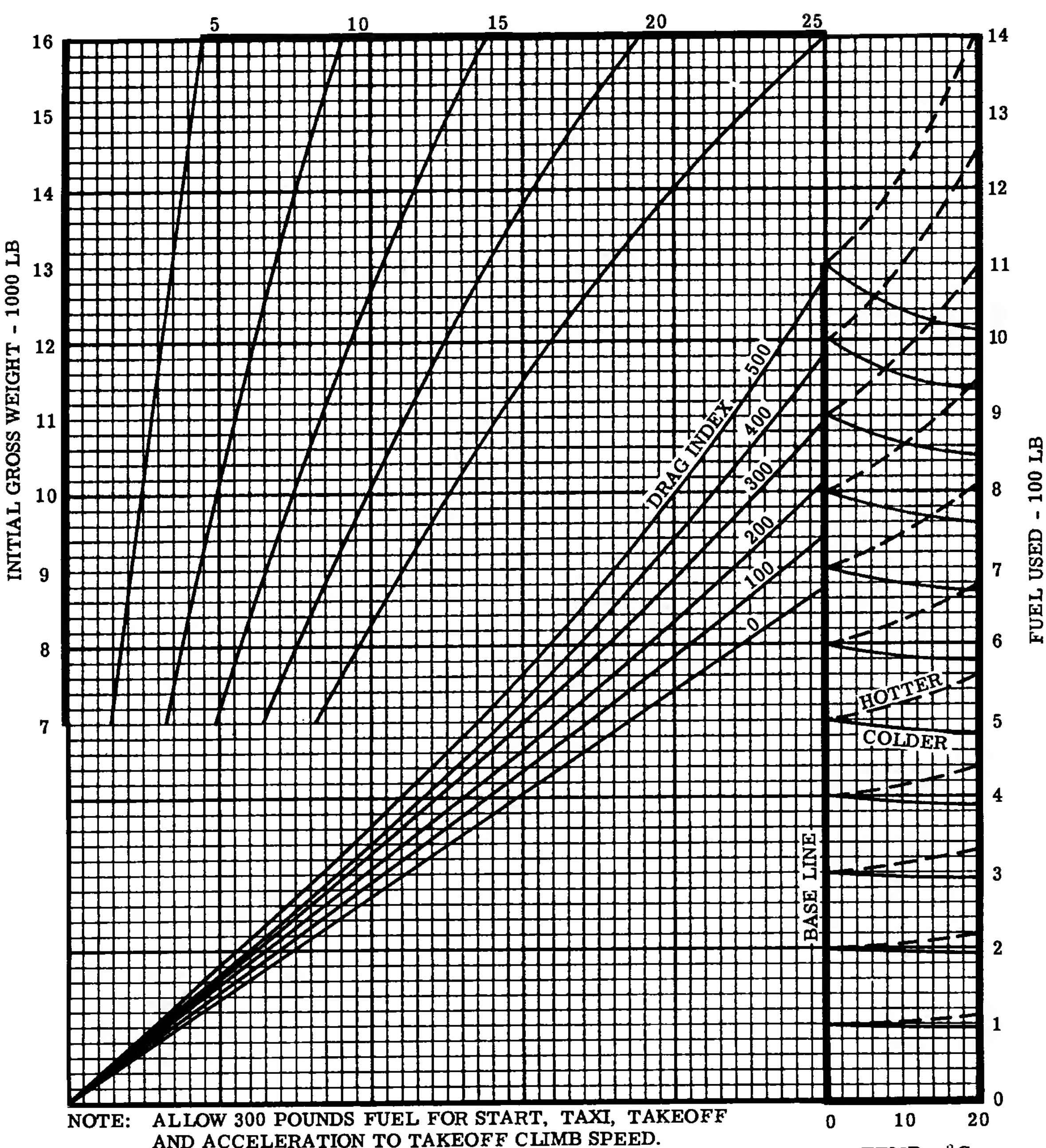
MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

TWO ENGINES

NORMAL THRUST (97.9% RPM)





NOTE: ALLOW 300 POUNDS FUEL FOR START, TAXI, TAKEOFF AND ACCELERATION TO TAKEOFF CLIMB SPEED.

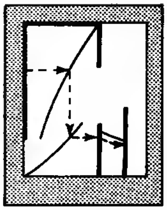
Figure A3-2 (Sheet 2 of 3)

FUEL USED TO CLIMB

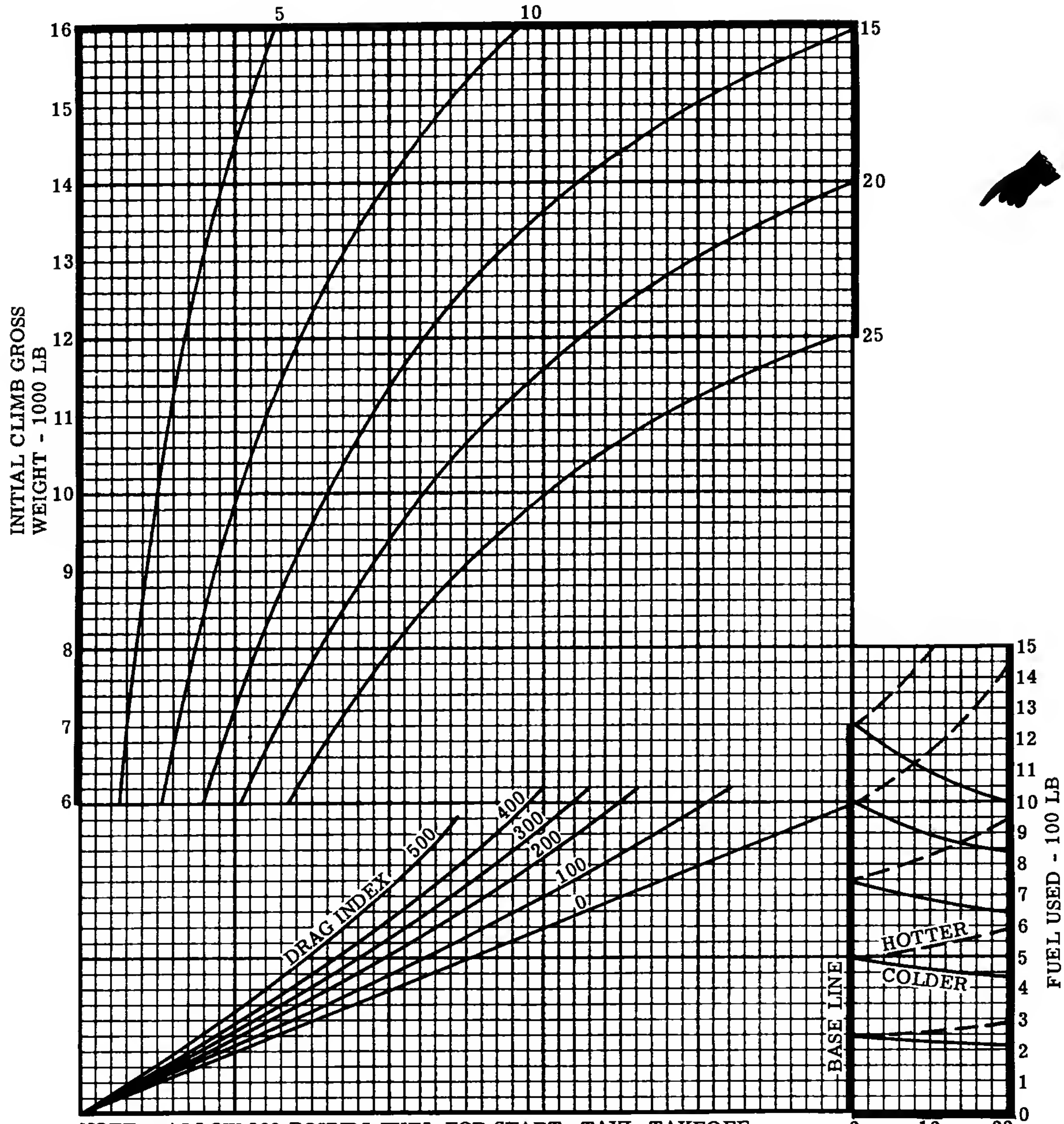
MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

SINGLE ENGINE

MAXIMUM THRUST



STANDARD DAY
ENGINES: (1) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



NOTE: ALLOW 300 POUNDS FUEL FOR START, TAXI, TAKEOFF AND ACCELERATION TO TAKEOFF CLIMB SPEED.

Figure A3-2 (Sheet 3 of 3)

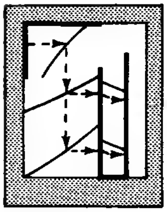
TIME TO CLIMB AND HORIZONTAL DISTANCE TRAVELED DURING CLIMB

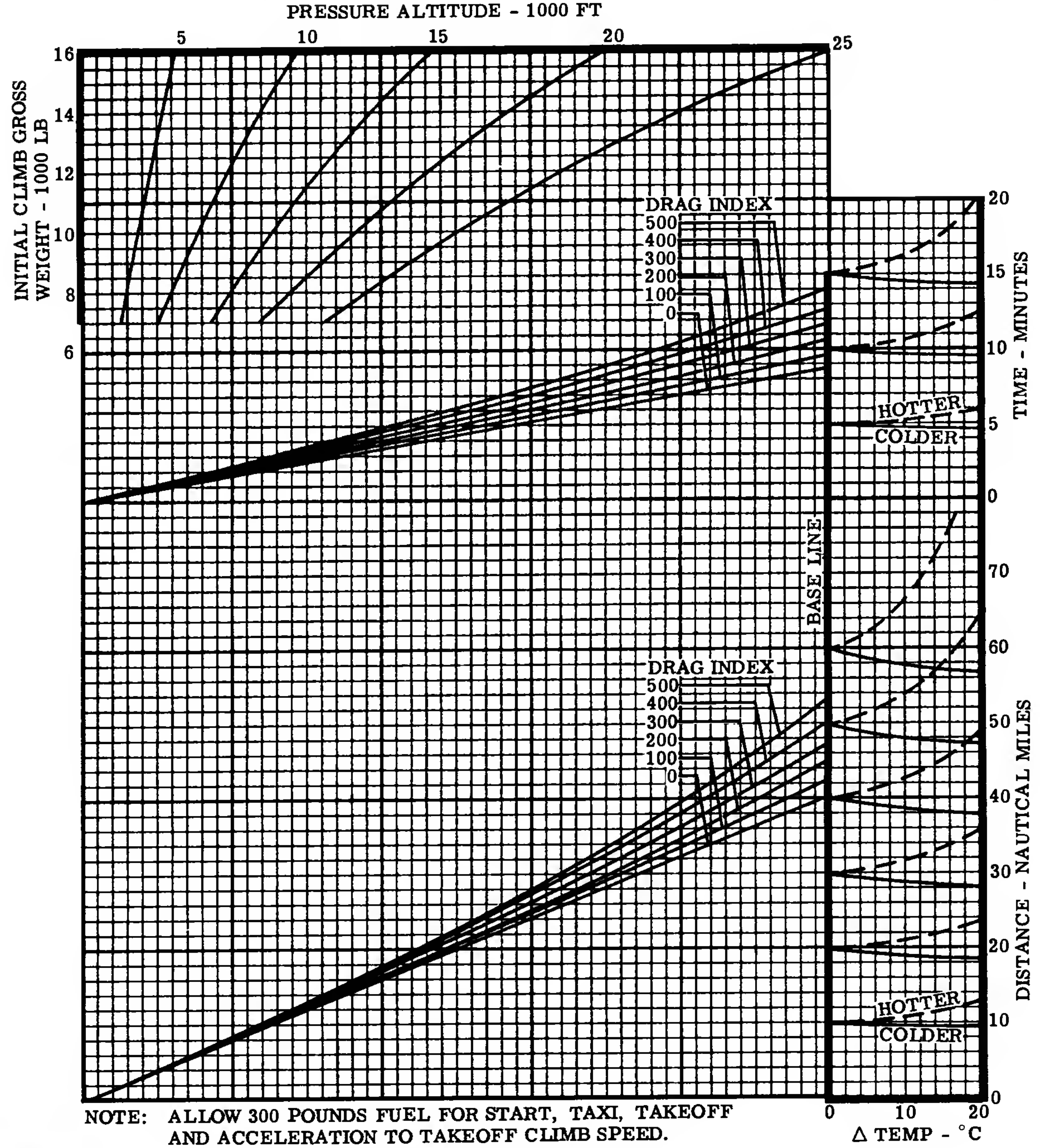
MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

TWO ENGINES

MAXIMUM THRUST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL





NOTE: ALLOW 300 POUNDS FUEL FOR START, TAXI, TAKEOFF AND ACCELERATION TO TAKEOFF CLIMB SPEED.

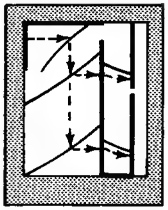
Figure A3-3 (Sheet 1 of 3)

TIME TO CLIMB AND HORIZONTAL DISTANCE TRAVELED DURING CLIMB

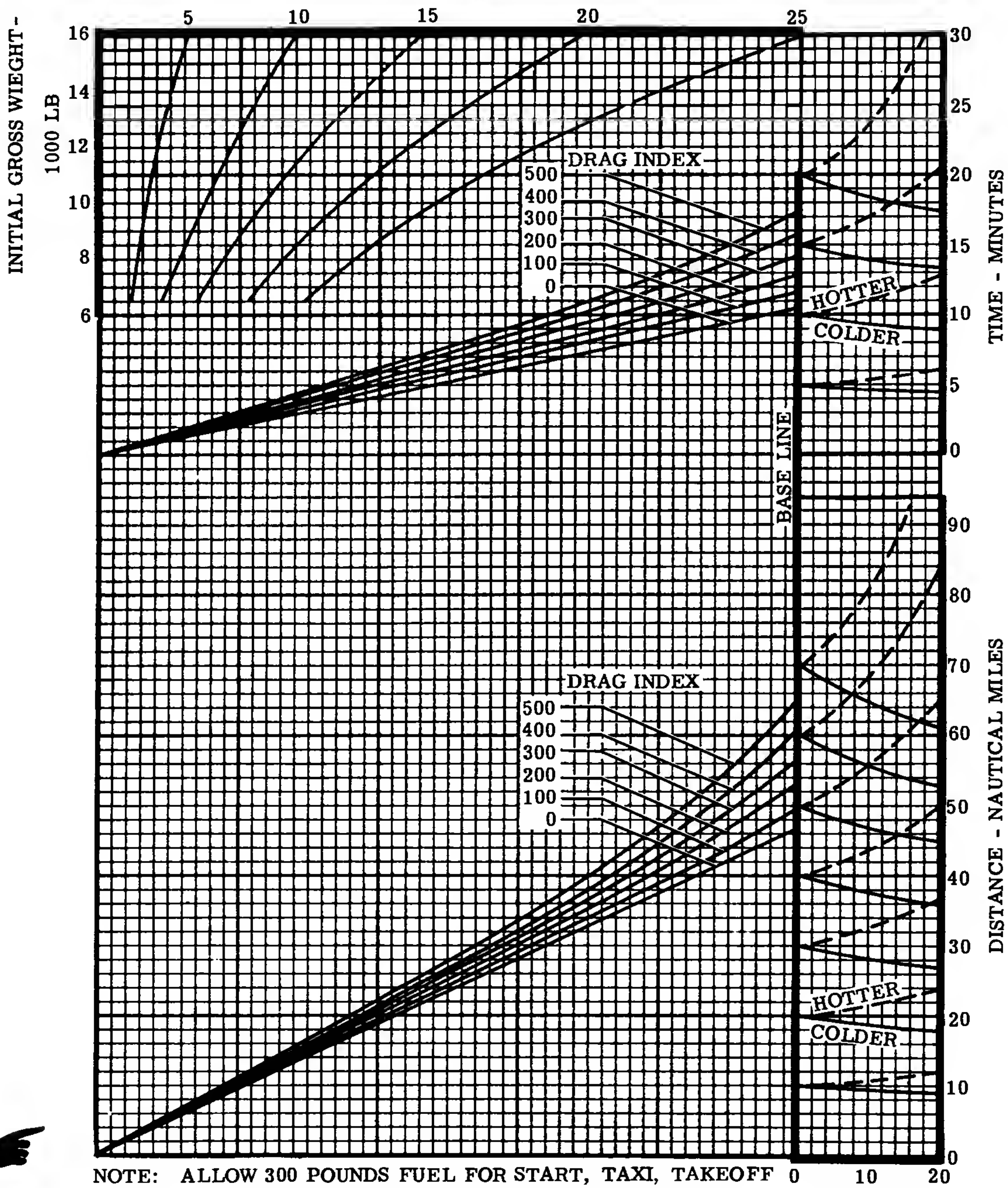
MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

TWO ENGINES

NORMAL THRUST (97.9% RPM)



STANDARD DAY
ENGINES: (I) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



NOTE: ALLOW 300 POUNDS FUEL FOR START, TAXI, TAKEOFF AND ACCELERATION TO TAKEOFF CLIMB SPEED.

Figure A3-3 (Sheet 2 of 3)

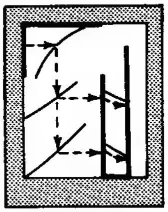
TIME TO CLIMB AND HORIZONTAL DISTANCE TRAVELED DURING CLIMB

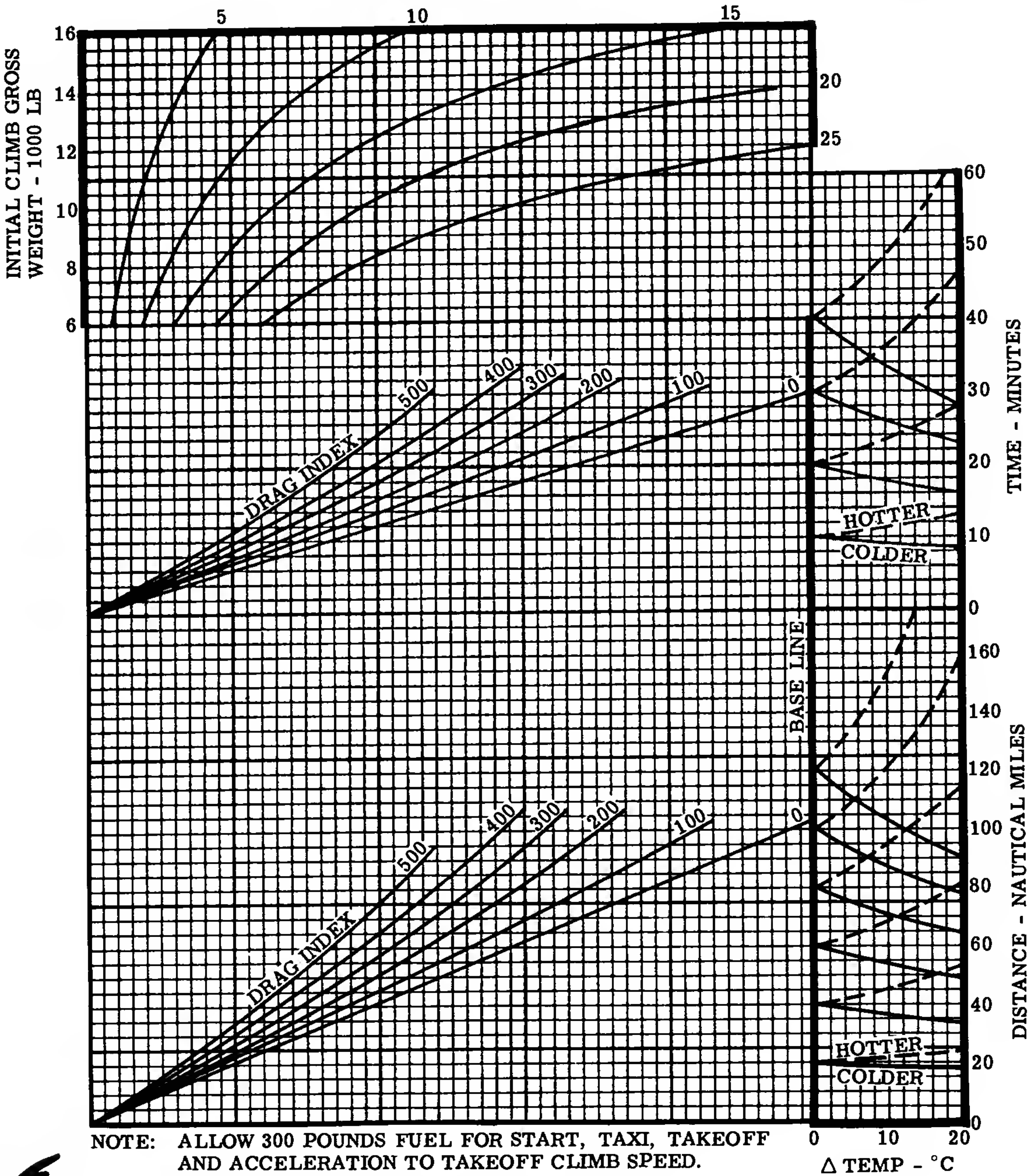
MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

SINGLE ENGINE

MAXIMUM THRUST

STANDARD DAY
ENGINES: (1) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL





NOTE: ALLOW 300 POUNDS FUEL FOR START, TAXI, TAKEOFF AND ACCELERATION TO TAKEOFF CLIMB SPEED.

Figure A3-3 (Sheet 3 of 3)

PART IV — RANGE

TABLE OF CONTENTS

MACH NUMBER - CALIBRATED AIRSPEED CHART.

This chart (figure A4-1) converts true Mach number to calibrated airspeed in knots, or calibrated airspeed to true Mach number at any pressure altitude. Compressibility has been accounted for and no further corrections are necessary.

USE.

To convert true Mach number to calibrated airspeed enter the chart with the appropriate altitude and proceed vertically upward to the proper true Mach number reflector. Project horizontally to the left and read calibrated airspeed. To convert calibrated airspeed to true Mach number enter calibrated airspeed and project horizontally across the chart. Enter with proper altitude and project vertically upward and intersect the airspeed projection. At this intersection read the true Mach number.

SAMPLE PROBLEM.

Given:
1. Altitude = 15, 000 ft.
2. True Mach number = 0. 40

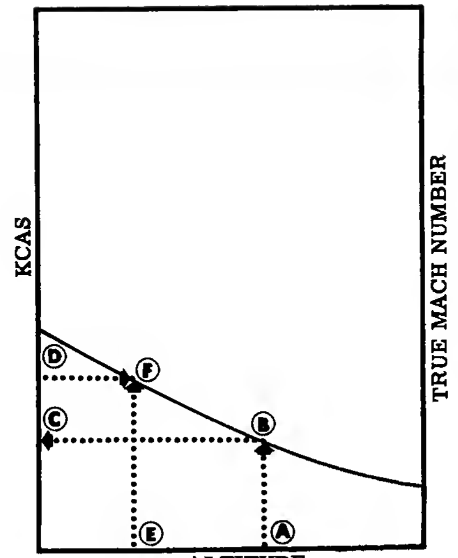
Find calibrated airspeed:

A.	Altitude	15, 000 ft.
B.	True Mach number	0. 40
C.	Calibrated airspeed	200 KCAS

Find True Mach number:

D.	Calibrated airspeed	230 KCAS
E.	Altitude	7500 ft.
F.	True Mach number	0. 40

SAMPLE MACH NUMBER - CALIBRATED AIRSPEED CHART



CONSTANT ALTITUDE CRUISE CHARTS.

The Constant Altitude Cruise Charts should be used for mission planning when optimum range capability or cruise at normal thrust setting is desired. The charts provide cruise performance and cruise control information for operation at 99% - maximum range speeds for two engines (figures A4-2 and A4-3) and for single engine (figures A4-4 and A4-5). Normal thrust cruise (97. 9% RPM) is presented in figures A4-6 and A4-7. Figures A4-2, A4-4 and A4-6 provide true airspeed, ground speed and cruise time as a function of gross weight, altitude, drag index, ambient temperature and wind speed. Figures A4-3, A4-5 and A4-7 provide specific range, fuel flow rate and fuel required as a function of gross weight, altitude, drag index and true airspeed.

USE.

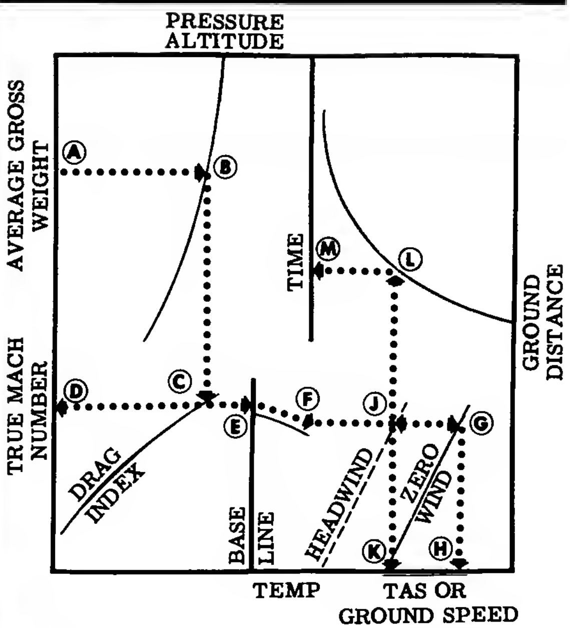
The average gross weight during the cruise leg is used to enter the charts. This may be found from an initial estimate of cruise fuel required (gross weight at start of cruise less one half of estimated fuel). The estimated fuel used should be checked

against the computed fuel required, and, if there is a substantial difference, the problem should be reworked with a new average gross weight that is based on the computed fuel.

Using the average gross weight for the cruise leg found above, enter the appropriate Time and Airspeed chart (figure A4-2, A4-4 or A4-6), projecting horizontally right to the pressure altitude reflector, then vertically down to drag index. Move horizontally left and read true mach number. Return to the point of ntersection on the drag index curve and continue horizontally right to the temperature base line, then parallel to the nearest guide line to the temperature at cruise altitude. Move horizontally right from this point to the zero wind line and read true airspeed on the scale at the bottom of the chart. Make note of this speed for use on the next chart. Return to the point of intersection on the zero wind line and correct the airspeed to ground speed by moving horizontally left (for headwind) or horizontally right (for tailwind) by the amount of the wind and read the ground speed on the same scale at the bottom of the chart. Move vertically up, at the correct ground speed, to the ground distance applicable to cruise (interpolate between curves, if necessary), then horizontally left and read time to cruise.

Enter the appropriate Fuel Flow and Fuel Required chart (figure A4-3, A4-5, or A4-7) with the average gross weight. Move horizontally right to the pressure altitude and vertically down to the drag index. Read the air-nautical-miles-per-pound-of-fuel on the scale to the left of the chart; then, returning to the point of intersection on the drag index curve, move horizontally right to true airspeed, which was

SAMPLE CONSTANT ALTITUDE CRUISE



obtained from the previous chart (interpolate between curves if necessary). From this point, move vertically up, note the fuel flow pounds-per-hour, and continue up to the time required for cruise, which was also obtained from the previous chart. Move horizontally left and read fuel required.

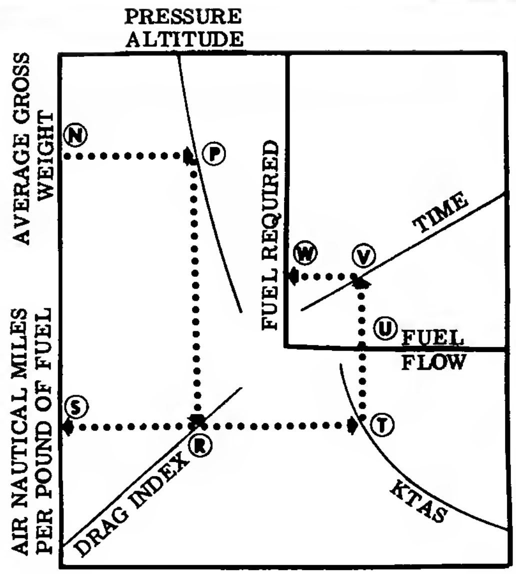
SAMPLE PROBLEM.

Given:
1. Cruise on two engines at 99% - maximum range speed
2. Average gross weight = 13, 000 lbs.
3. Drag index = 200
4. Pressure altitude = 25, 000 ft.
5. Temperature at altitude = - 40°C.
6. Wind speed = 60 Kt. (headwind)
7. Cruise distance = 180 n. mi.

Find: Cruise Mach number, cruise time, ground speed. fuel flow and fuel required.

Use constant altitude cruise chart figure A4-2:

SAMPLE CONSTANT ALTITUDE CRUISE



A.	Average gross weight	13, 000 lbs.
B.	Pressure altitude	25, 000 ft.
C.	Drag Index	200
D.	True Mach number	. 488
E.	Base line	
F.	Temperature	-40°C.
G.	Zero wind	
H.	True airspeed	291 Kt.
J.	Headwind	60 Kt.
K.	Ground speed	231 Kt.
L.	Ground distance	180 n. mi.
M.	Time	47 min.

Use constant altitude cruise chart, figure A4-3:

N. Average gross weight	13, 000 lb.
P. Pressure altitude	25, 000 ft.
R. Drag index	200
S. Air-nautical-miles-per-pound-of-fuel	. 154
T. True airspeed	291 Kt.
U. Fuel flow	1900 lb/hr.
V. Time	47 min.
W. Fuel required	1480 lb.

ALTERNATE USE

If the fuel available for cruise is known, cruise distance may be found by using the following method:

1. Enter the Time and Airspeed chart as described above and proceed to obtain true airspeed.
2. Enter the Fuel Flow and Fuel Required chart and proceed as described above to obtain fuel flow pounds-per-hour. Construct a vertical line up from the fuel flow value and a horizontal line to the right from the fuel required scale, using, in this case, the fuel available for cruise. At the intersection of the two lines, read the time required for cruise.
3. Return to the Time and Airspeed chart. From the intersection that was found on the zero wind reflector, correct horizontally to the right or the left for wind and note ground speed. Construct a vertical line up from ground speed, and a horizontal line to the right from the time required for cruise. At the intersection of the two lines, read the ground distance.

CRUISE DATA.

This data (figures A4-8 and A4-9) present true Mach number, specific fuel consumption (nautical miles per pound of fuel), true airspeed, and fuel flow for two engine and single engine operation, with or without external stores.

The recommended procedure is to use an average gross weight. To find the average gross weight, divide the mission fuel weight into segments. Subtract one-half of the fuel weight allotted for the first segment from the initial cruise gross weight. The remainder is the average gross weight for the first leg of the mission. With this method, readjust the average cruise gross weight each time a segment of fuel is used. It is possible to obtain instantaneous data, if desired.

USE.

Enter the Mach Number and Basic Reference Number Cruise Data (for either two engine or single engine operation) with the average weight and proceed horizontally to the right and intersect the appropriate pressure altitude reflector. From the pressure altitude reflector, project vertically downward and read the true Mach number. This is the optimum cruise (100% maximum range) true Mach number for zero drag index (clean aircraft, no external stores) only. If this is the cruise speed desired, continue down to the base line and project horizontally to the right and read the basic reference number. Omit the Correction of Basic Reference Number for External Stores and go directly to the Air Nautical Miles Per Pound of Fuel Cruise Data. The basic reference number represents the relative drag of the clean aircraft at the speed for optimum range. If optimum cruise is not desired, from the altitude reflector, project vertically downward and intersect the base line. From the base line, sketch in a line parallel to the reference lines in a direction towards the desired true Mach number. Return to the true Mach number scale and project vertically downward from the desired true Mach number and intersect the sketched in line. From this intersection project horizontally to the right and read basic reference number. Enter the Correction of Basic Reference Number for External Stores Cruise Data with the basic reference number and project horizontally to the right, through the reference number plot. Enter with the desired true Mach number and project horizontally to the right to the appropriate drag index reflector, then vertically downward, and intersect the basic reference number projection. At the intersection of these two lines read the corrected reference number. For drag index zero, the basic reference number and the corrected reference number are equal. The Correction of Basic Reference Number for External Stores Cruise Data may be omitted, using the basic reference number for the corrected reference number reflector on the Air Nautical Miles per Pound of Fuel Cruise Data. Erter the Air Nautical Miles per Pound of Fuel Cruise Data with the deslred true Mach number, and proceed horizontally to the right to the proper corrected reference number reflector. Project vertically up to the appropriate pressure altitude reflector, then horlzontally to the right and read the air nautical miles per pound of fuel. Enter the Fuel Flow and True Airspeed Cruise Data with the air nautical mile per pound of fuel and project horizontally to the right across the fuel flow portion of the chart. Enter with the true Mach number, and project horizontally to the right to the proper temperature reflector. Proceed vertically upward and read true airspeed. Continue upward and intersect the air nautical miles per pound of fuel projection. At the intersection of the air nautical miles per pound of fuel and true airspeed projections, read the fuel flow (pounds per hour).

SAMPLE PROBLEM.

Given:
1. Two engine cruise
2. Average gross weight = 11, 000 lb.
3. Pressure altitude = 20, 000 ft.
4. True Mach number = 0. 50
5. Drag index = 300

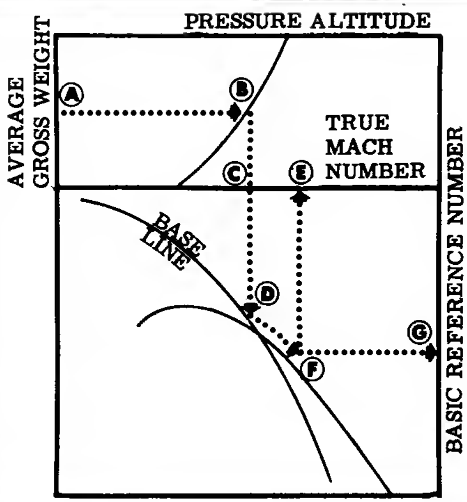
Find true airspeed and fuel flow:
Mach Number and Basic Reference Number Cruise Data:

A. Average gross weight	11, 000 lb.
B. Pressure altitude	20, 000 ft.

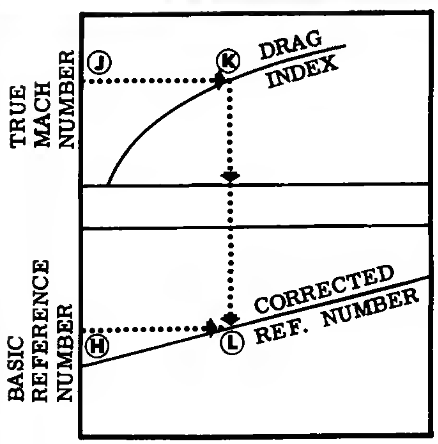
C. True Mach number for optimum cruise at zero drag index — 0. 444

D. Base line. Sketch in a line parallel to guidelines in a direction toward desired true Mach number

SAMPLE CRUISE DATA
(two engine)



SAMPLE CRUISE DATA
(two engine)



E. Desired cruise Mach number — 0. 50

F. Intersect sketched line

G. Basic reference number — 14. 9

Correction of Basic Reference Number Cruise Data:

H.	Basic reference number	14. 9
J.	True Mach number	0. 50
K.	Drag index	300
L.	Corrected reference number	20

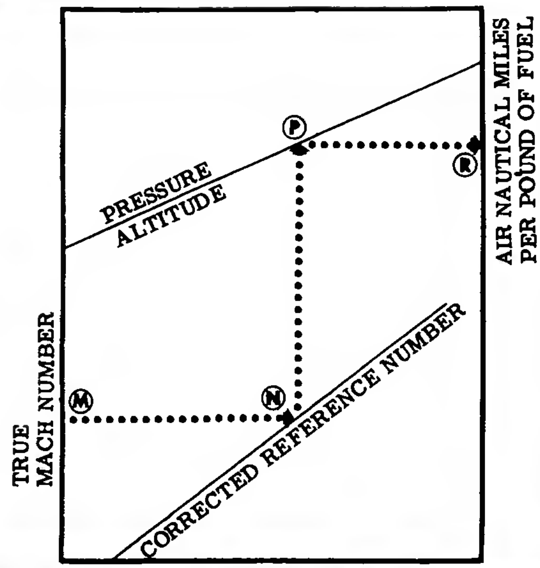
Air Nautical Miles Per Pound of Fuel Cruise Data:

M.	True Mach number	0. 50
N.	Corrected reference number	20
P.	Pressure altitude	20, 000 ft.
R.	Air nautical miles per pound of fuel	0. 128 NMI/lb.

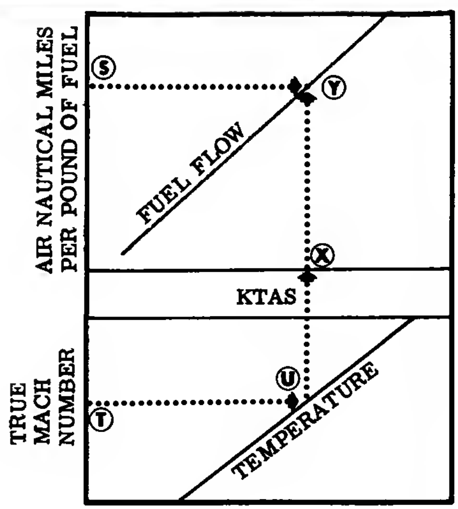
Fuel Flow and True Airspeed Cruise Data:

S.	Air nautical miles per pound of fuel	0. 128 NMI/lb.
T.	True Mach number	0. 50
U.	Temperature at cruise altitude	-25°C
X.	True airspeed	310 Kts.
Y.	Fuel flow	2400 lb/hr

SAMPLE CRUISE DATA
(two engine)



SAMPLE CRUISE DATA
(two engine)



SAMPLE PROBLEM.

Given:

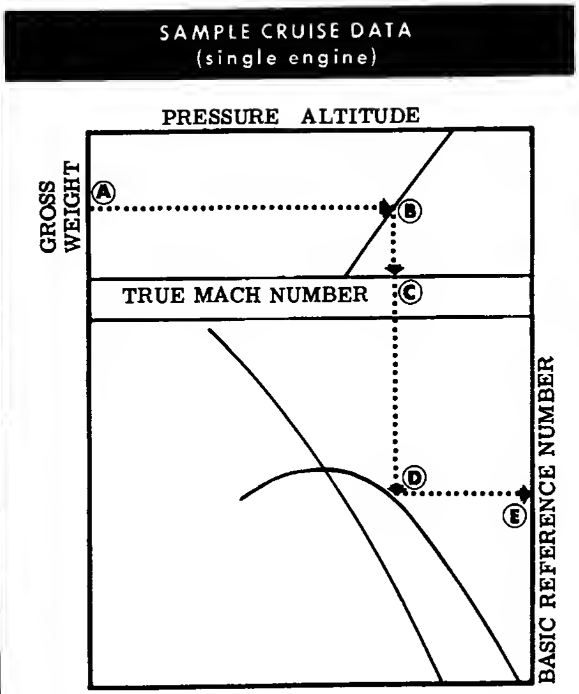
1. Cruise on one engine at true Mach number
2. Gross weight = 11, 000 lb, zero drag index
3. Pressure altitude = 15, 000 ft.

Find true Mach number, TAS, and fuel flow.

Mach Number and Basic Reference Number Cruise Data:

A.	Average gross weight	11, 000 lb.
B.	Pressure altitude	15, 000 ft.
C.	True Mach number for optimum range	0. 362
D.	Base line	
E.	Basic reference number	18. 4

Omit Correction of Basic Reference Number for External Stores Cruise Data:

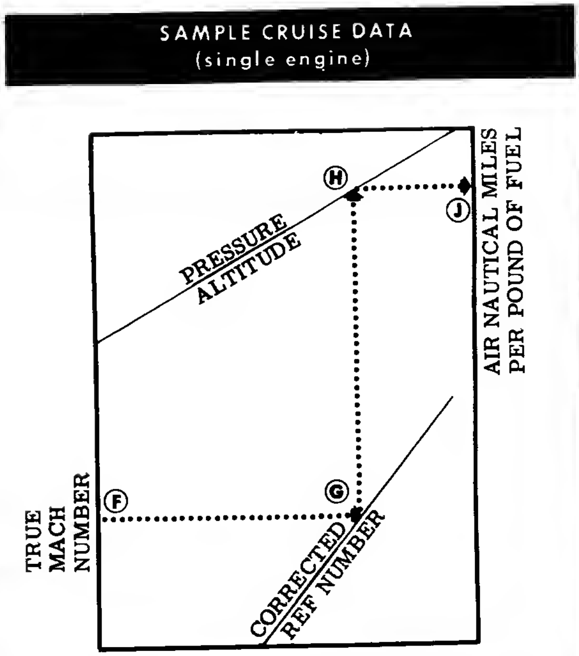


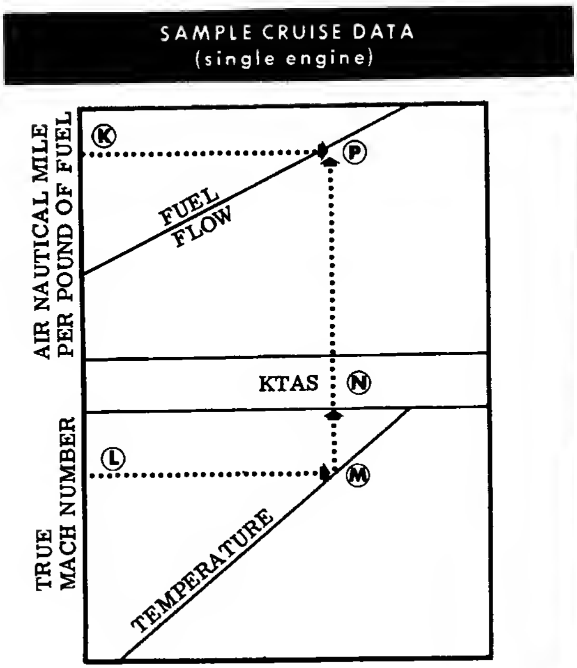
Air Nautical Miles Per Pound of Fuel Cruise Data:

F.	True Mach number	0. 362
G.	Corrected reference number, same as basic reference number at zero drag index	
H.	Pressure altitude	15, 000 ft.
J.	Air nautical miles per pound of fuel	0. 171 NMI/lb.

Fuel Flow and True Airspeed Cruise Data:

K.	Air nautical miles per pound of fuel	0. 171 NMI/lb.
L.	True Mach number	0. 362
M.	Temperature at cruise altitude	-35°C
N.	True airspeed	220 Kts.
P.	Fuel flow	1300 lb/hr.





OPTIMUM CRUISE ALTITUDE CHART.

These charts, figure A4-10, give the optimum cruise pressure altitude for best range for two and single engine operation respectively. Corrections are provided for deviations from standard day conditions of ±20°C.

Only a limited weight range is presented for two engine operation. Optimum cruise pressure altitude for two engine operation is 25,000 feet at all weights and drag indices for standard day and cold day (std. day -20°C). Optimum cruise pressure altitude does not fall below 25,000 feet except during hot day (std. day +20°C) operation at weights above 14,800 pound gross weight.

USE.

Enter the appropriate chart, for either single or two engine operation, with the average gross weight and proceed horizontally to the right to the proper drag index reflector. From the drag index reflector project vertically down and intersect the proper temperature reflector. From the temperature reflector, project horizontally to the right and read the pressure altitude. Both charts are used in the same manner.

SAMPLE PROBLEM.

Given:

1.	Two engine operation	
2.	Gross weight =	15,500 lb.
3.	Drag index =	400
4.	Δ Temperature =	+20°C

Find optimum cruise altitude:

A.	Gross weight =	15,500 lb.
B.	Drag index =	400
C.	Δ Temperature =	+20°C
D.	Pressure altitude =	24,350 ft.

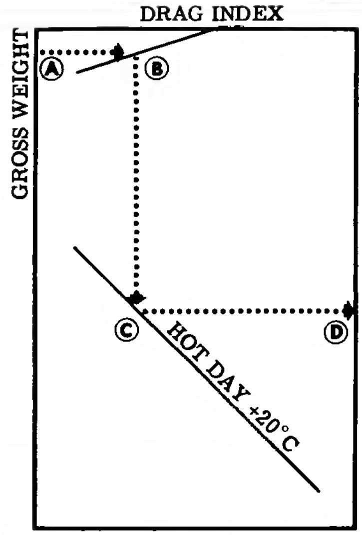
Given:

1.	Single engine operation	
2.	Gross weight =	11,000 lb.
3.	Drag index =	200
4.	Standard day	

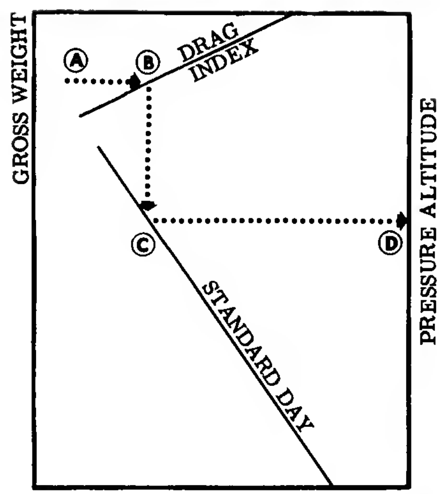
Find optimum cruise altitude:

A.	Gross weight =	11,000 lb.
B.	Drag index =	200
C.	Δ Temperature =	0°C (Std. day)
D.	Pressure altitude =	19,200 ft.

SAMPLE OPTIMUM CRUISE ALTITUDE CHART
(two engine)



SAMPLE OPTIMUM CRUISE ALTITUDE CHART
(single engine)



OPTIMUM CRUISE ALTITUDE FOR SHORT RANGE MISSIONS CHART.

This chart (figure A4-11) provides the optimum cruise pressure altitude for short range missions of 100 air nautical miles or less. For mission ranges greater than 100 air nautical miles, 25,000 feet is the optimum cruise pressure altitude.

USE.

Enter the chart with the start to climb gross weight and proceed horizontally to the proper drag index reflector. Project vertically downward to intersect the appropriate mission range and project horizontally to the right and read the pressure altitude.

SAMPLE PROBLEM.

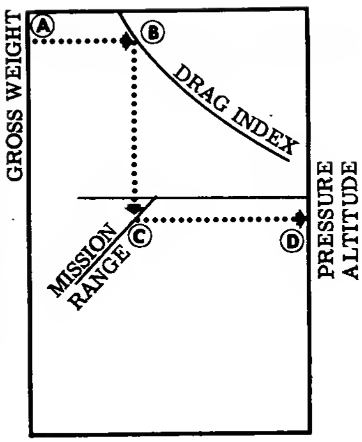
Given:

1.	Start to climb gross weight =	14,500 lb.
2.	Drag index =	200
3.	Mission range =	75 N. mi.

Find optimum cruise altitude:

A.	Start to climb gross weight	14,500 lb.
B.	Drag index	200
C.	Mission range	75 N. mi.
D.	Pressure altitude	23,000 ft.

SAMPLE OPTIMUM CRUISE ALTITUDE FOR SHORT RANGE MISSIONS CHART



DIVERSION RANGE SUMMARY TABLE.

Diversion Range Summary Tables are presented for two engine and one engine operation, standard day conditions and no wind, with two pylon tanks. The tables show, in quick reference form, the range obtainable with 600, 800 and 1000 pounds of fuel available. The range pertains to the configuration stated above and based on having 300 pounds of fuel remaining for approach and landing after descent is completed. The 300 pounds of fuel is ample for one approach and one "go-around."

Range data is shown in the tables for two optional return profiles, together with the optimum altitude for cruise. The optimum altitude is the altitude which provides the maximum range for the particular type of flight profile used. Two engine climb to optimum altitude is with normal thrust (97.8% RPM), and single engine climb is with maximum thrust. Cruise speeds and descent information are contained at the bottom of each diversion range chart.

The two types of flight profiles are:

1. a. Cruise at initial altitude.
   b. Descend to sea level at idle RPM, 200 KCAS, with speed brake in.
2. a. Climb on course to optimum altitude.
   b. Cruise at optimum altitude.
   c. Descent to sea level at idle RPM, 200 KCAS, with speed brake in.

SAMPLE PROBLEM.

Given:

1.	Configuration is with two pylon tanks and two engines operating	
2.	Initial altitude =	20, 000 ft.
3.	Distance to base =	85 N. mi.
4.	Fuel remaining =	850 lb.

Calculate:
Use Diversion Range Summary Table (figure A4-12).

A.	Ranges with options available	100 N. mi.
	(Use 800 lb. fuel column data)	107 N. mi.
B.	Option selected (nearest valve)	100 N. mi.
C.	Cruise altitude	20, 000 ft.
D.	Cruise speed	192 KCAS
E.	Cruise distance (on course)	47 N. mi.
F.	Descent distance	38 N. mi.
G.	Descent conditions	200 KCAS Idle RPM speed brake in
H.	Fuel remaining (850 - 800)	50 approx. +300 reserve 350 lb.

SAMPLE DIVERSION RANGE SUMMARY TABLE

TWO ENGINES

TWO PYLON TANKS

STANDARD DAY

ZERO WIND

FUEL AND RANGE REMAINING WITH 300 LB RESERVE AT SEA LEVEL								PROCEDURE
FUEL	1000 FT	SL	5	10	15	20	25	INITIAL ALTITUDE
600 LB	NMI	31	39	48	55	64	71	△ CRUISE AT INITIAL ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
	1000 FT	15	15	20	25	25	25	OPTIMUM ALTITUDE
	NMI	40	46	52	58	65	71	△ CRUISE AT OPTIMUM ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
800 LB	NMI	51	62	75	88	100	114	△ CRUISE AT INITIAL ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
	1000 FT	25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI	76	84	92	100	107	114	△ CRUISE AT OPTIMUM ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
1000 LB	NMI	72	87	102	119	137	155	△ CRUISE AT INITIAL ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
	1000 FT	25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI	117	125	133	141	148	155	△ CRUISE AT OPTIMUM ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
CRUISE ALT		SL	5	10	15	20	25	△ FUEL AND DISTANCE INCLUDED FOR DESCENT TO DESTINATION.
CRUISE KCAS		234	222	211	201	192	183	
DESCENT △	NMI REMAINING		12	22	30	38	45	△ FUEL AND DISTANCE INCLUDED FOR CLIMB TO OPT. ALT. AND DESCENT TO DESTINATION.
	FUEL REMAINING		367	411	440	460	473	△ DESCENT DATA TABULATED FOR IDLE RPM AND SPEED BRAKE (SB) IN.

NOTE: CLIMB AT 239 KCAS LESS 2 KNOTS PER 1000 FT ALTITUDE WITH NORMAL POWER (97.9% RPM).

MACH NUMBER – CALIBRATED AIRSPEED CHART

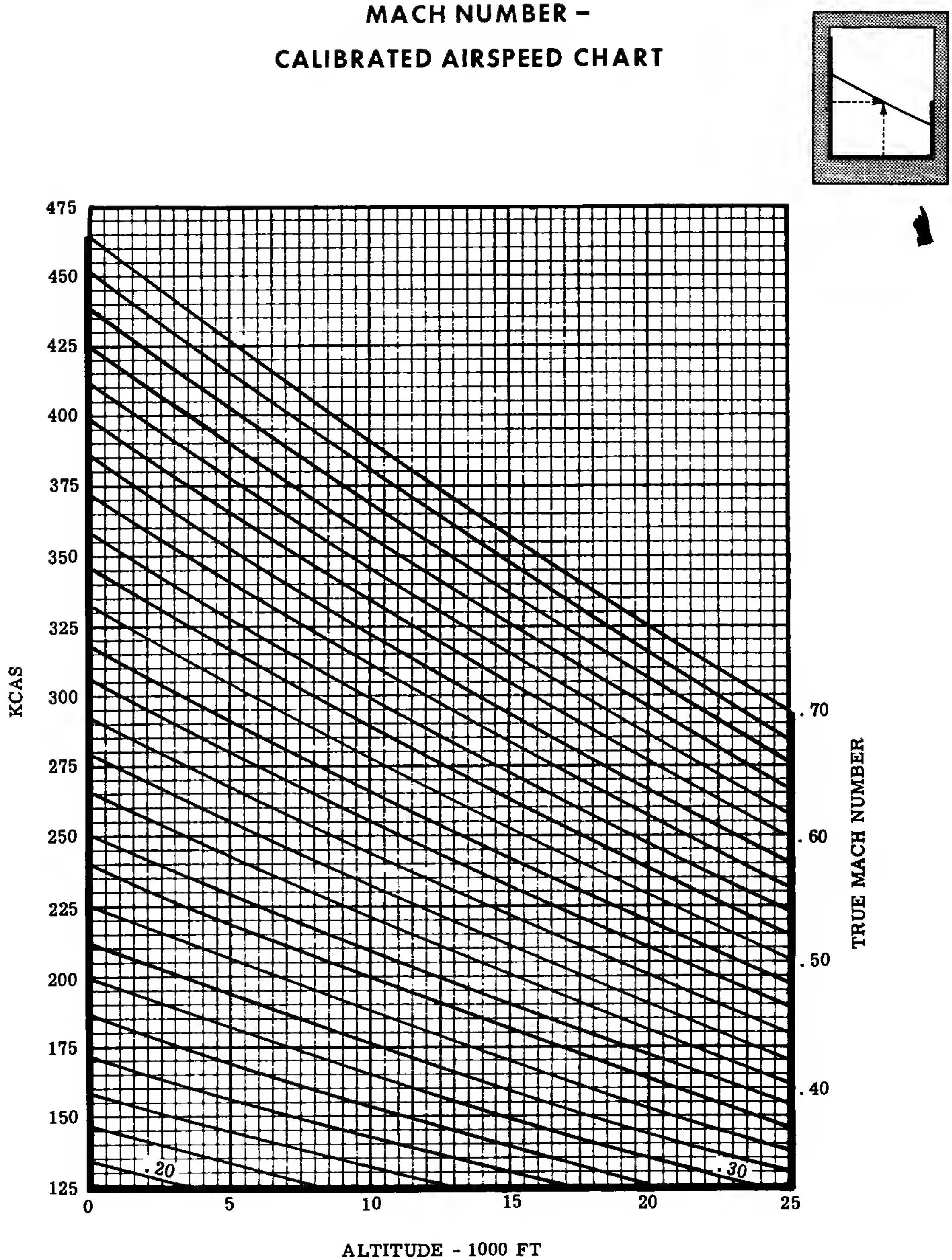


Figure A4-1

CONSTANT ALTITUDE CRUISE

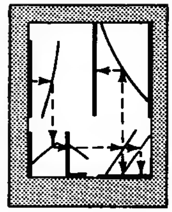
MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

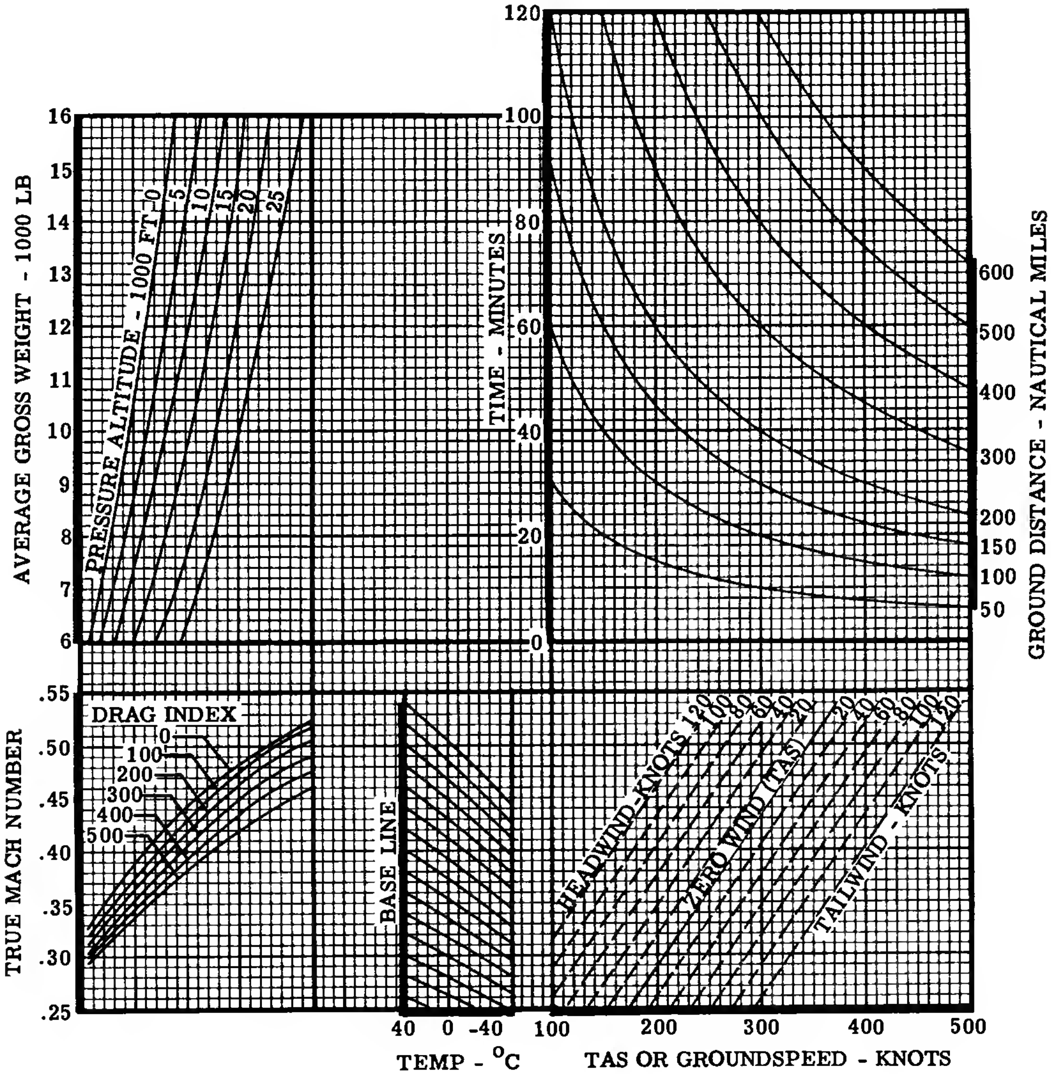
TWO ENGINES

99% MAXIMUM RANGE

TIME AND AIRSPEED

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL





STANDARD DAY						
ALT - 1000 FT	SL	5	10	15	20	25
TEMP - °C	15.0	5.1	-4.8	-14.7	-24.6	-34.5

Figure A4-2

CONSTANT ALTITUDE CRUISE

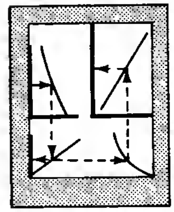
TWO ENGINES

99% MAXIMUM RANGE

FUEL FLOW AND FUEL REQUIRED

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



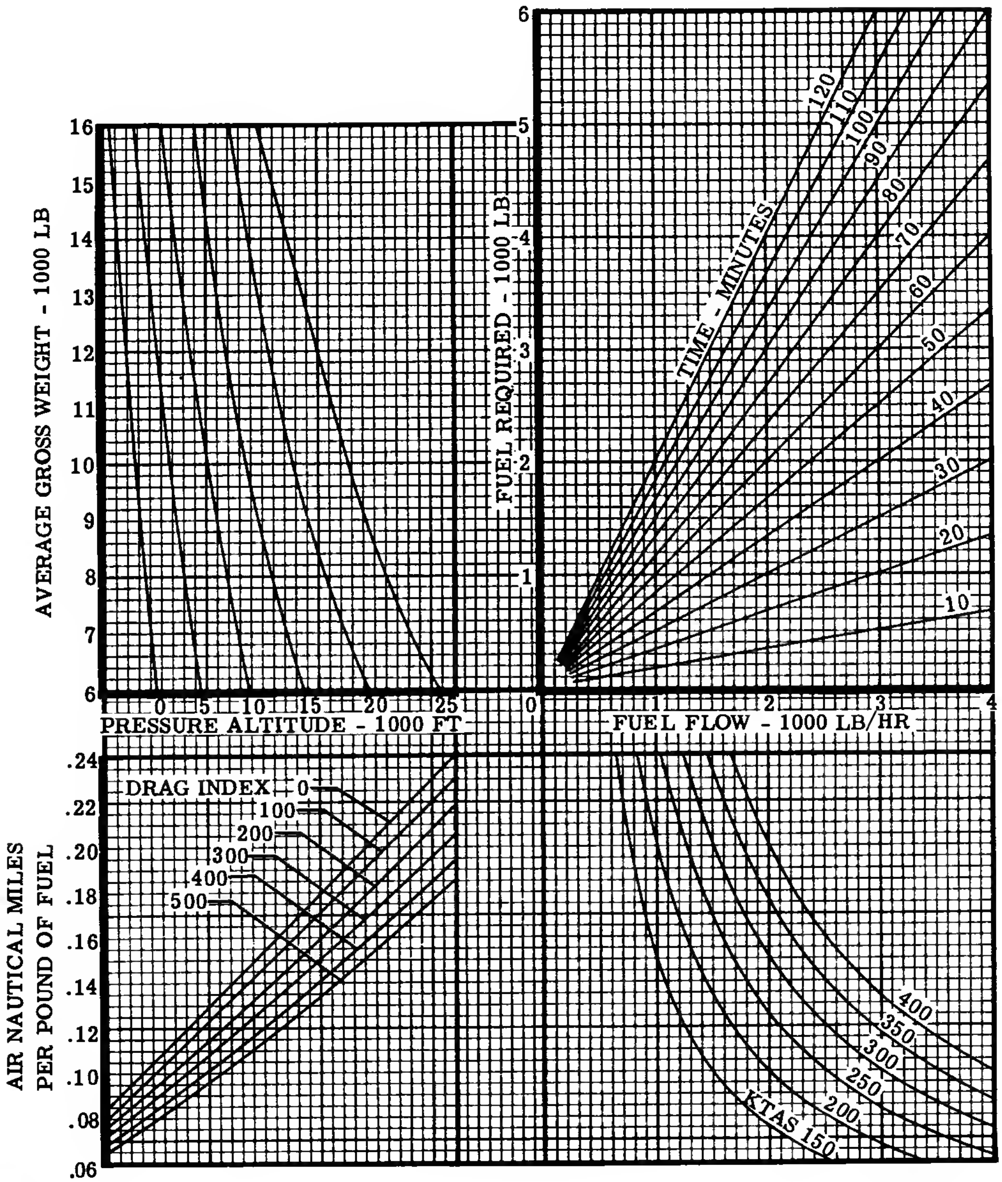


Figure A4-3

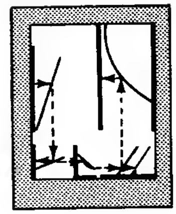
CONSTANT ALTITUDE CRUISE

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

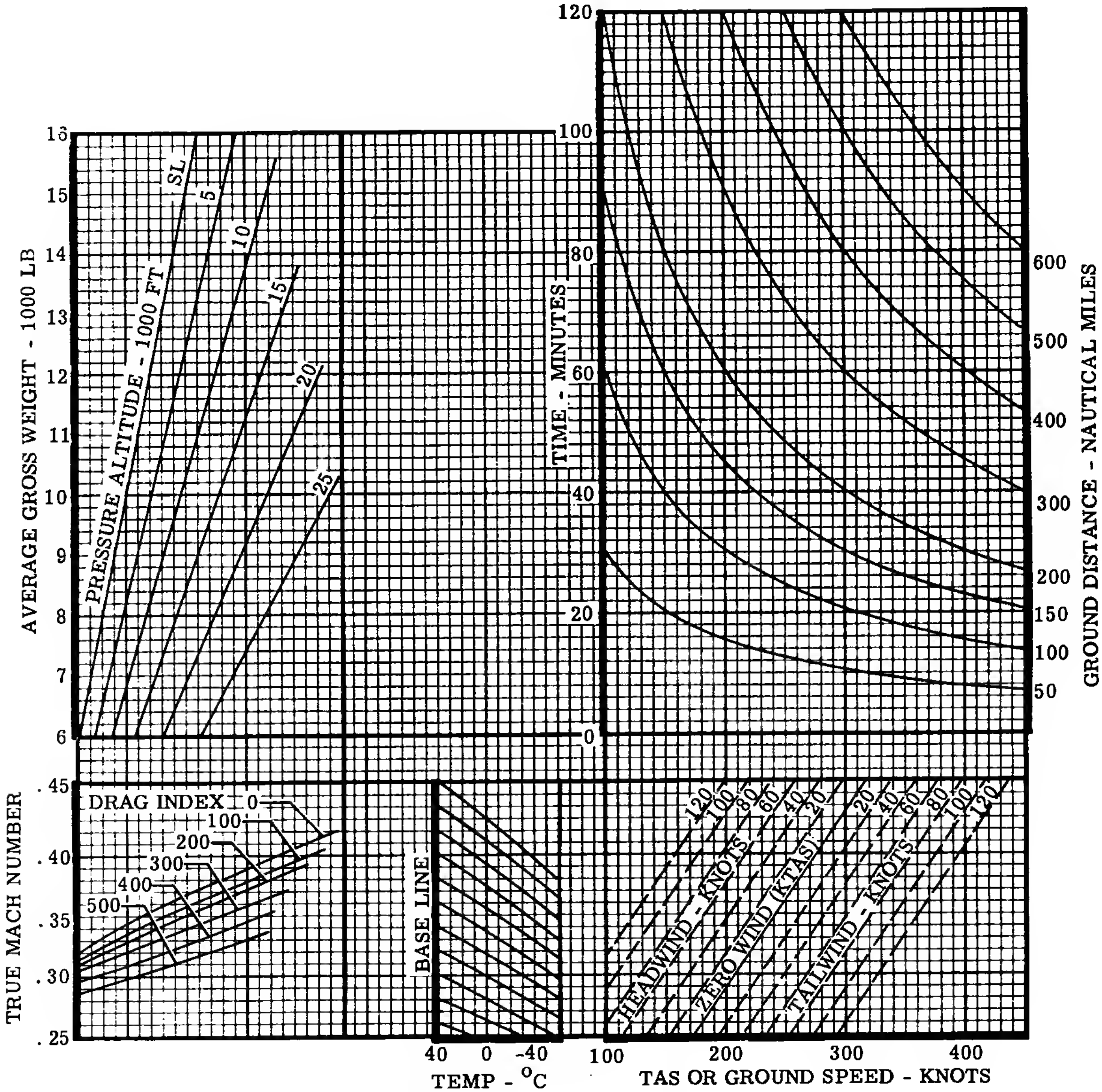
SINGLE ENGINE

99% MAXIMUM RANGE

TIME AND AIRSPEED



STANDARD DAY
ENGINES: (1) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



STANDARD DAY						
ALT - 1000 FT	SL	5	10	15	20	25
TEMP - °C	15.0	5.1	-4.8	-14.7	-24.6	-34.5

Figure A4-4

CONSTANT ALTITUDE CRUISE

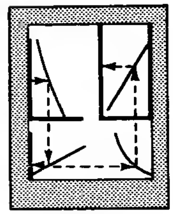
MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (1) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

SINGLE ENGINE

99% MAXIMUM RANGE

FUEL FLOW AND FUEL REQUIRED



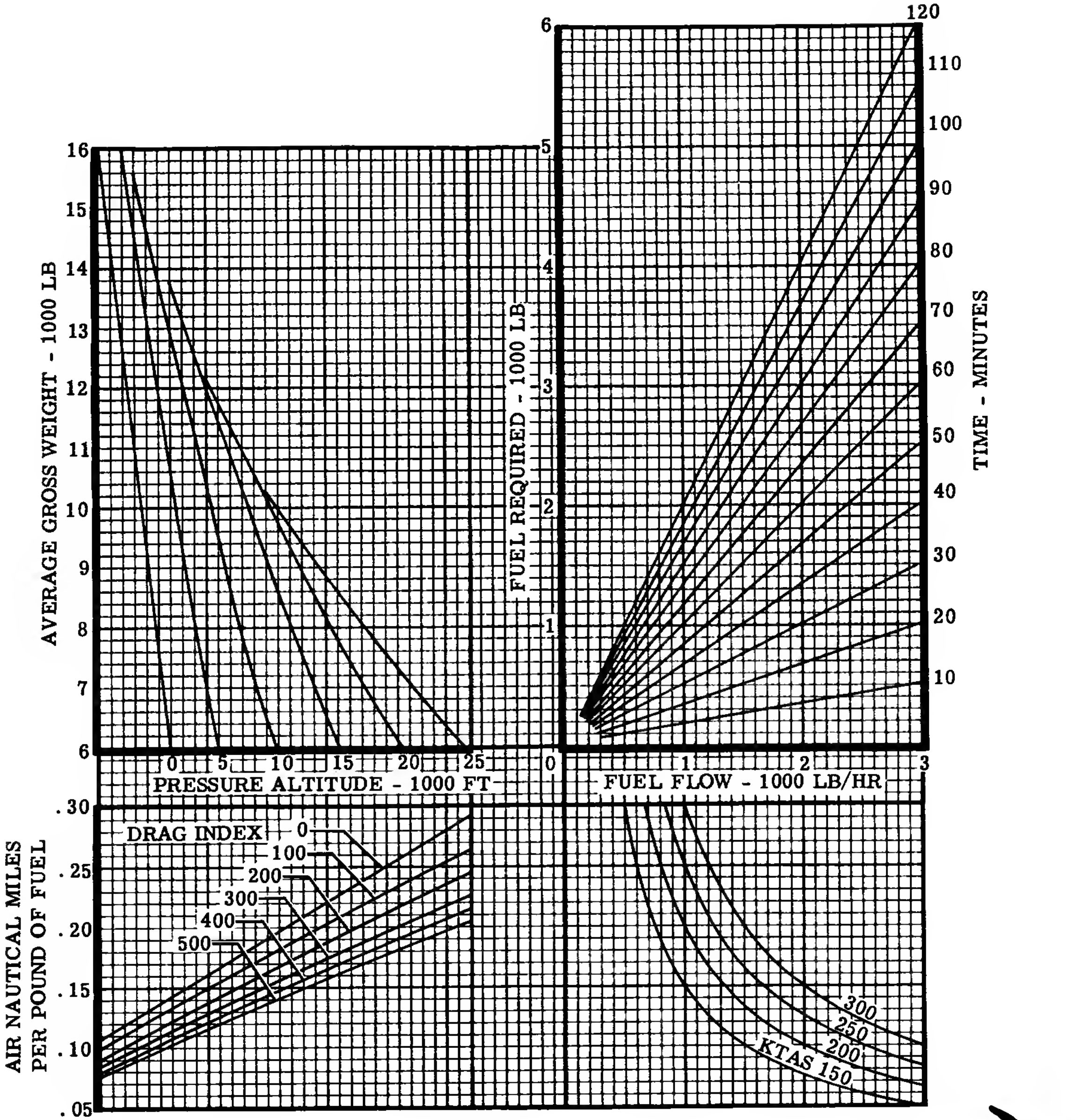


Figure A4-5

CONSTANT ALTITUDE CRUISE

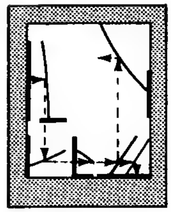
MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

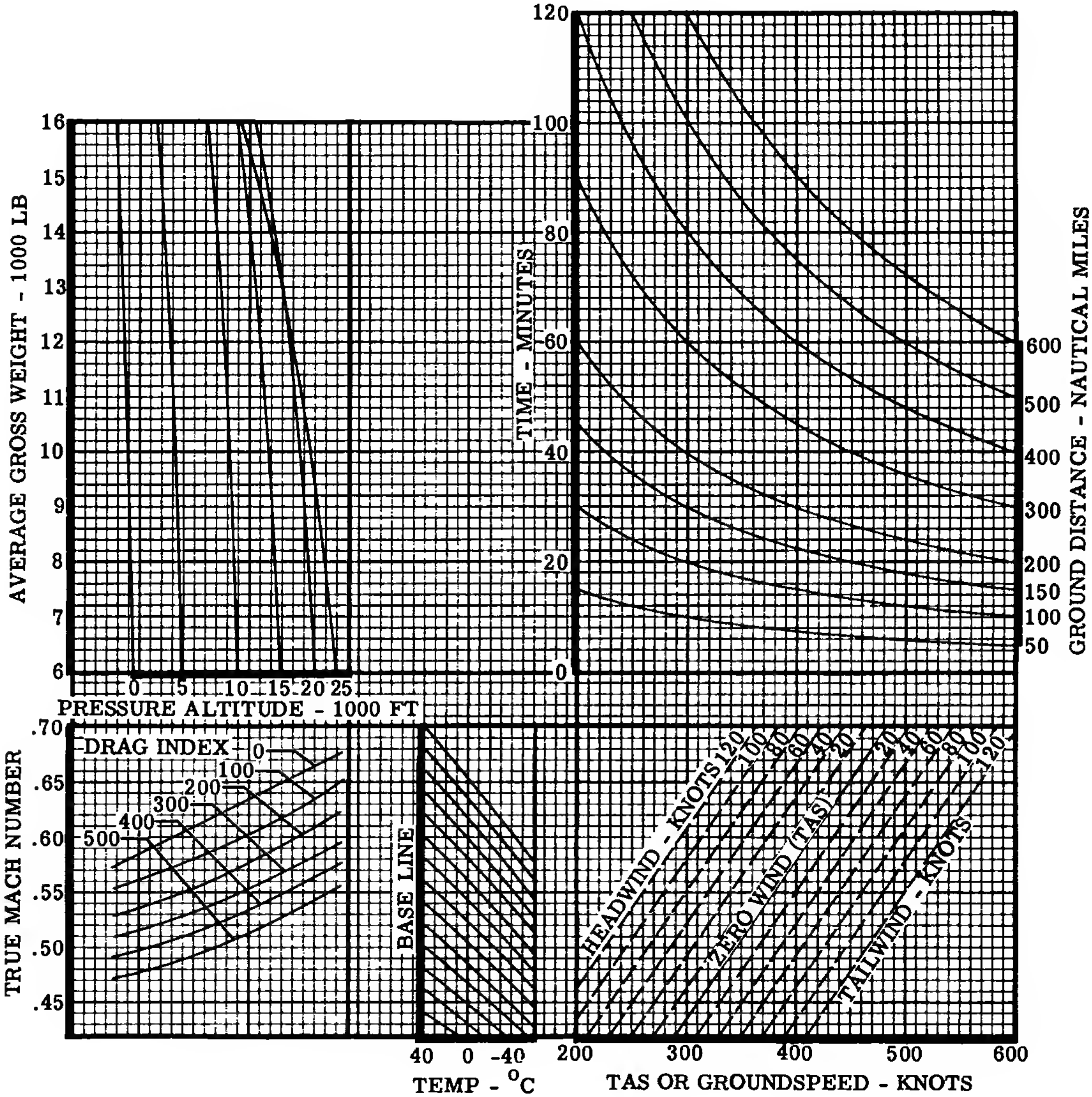
TWO ENGINES

97.9% RPM

TIME AND AIRSPEED

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL





STANDARD DAY						
ALT - 1000 FT	SL	5	10	15	20	25
TEMP - °C	15.0	5.1	-4.8	-14.7	-24.6	-34.5

Figure A4-6

CONSTANT ALTITUDE CRUISE

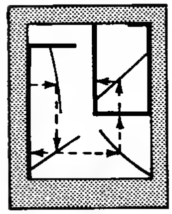
MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

TWO ENGINES

97.9% RPM

FUEL FLOW AND FUEL REQUIRED

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



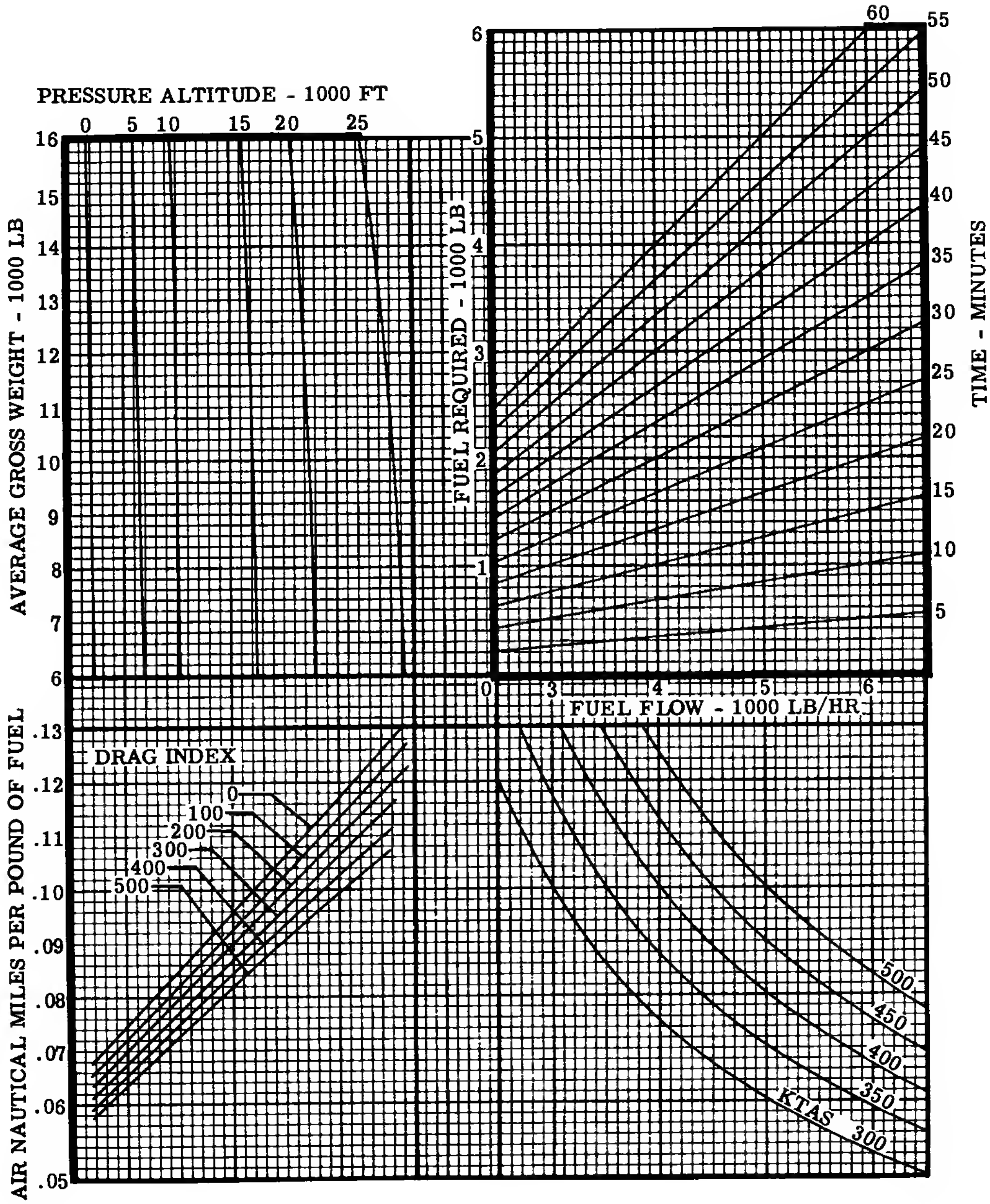


Figure A4-7

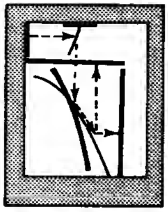
CRUISE DATA

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

TWO ENGINES

MACH NUMBER AND BASIC REFERENCE NUMBER



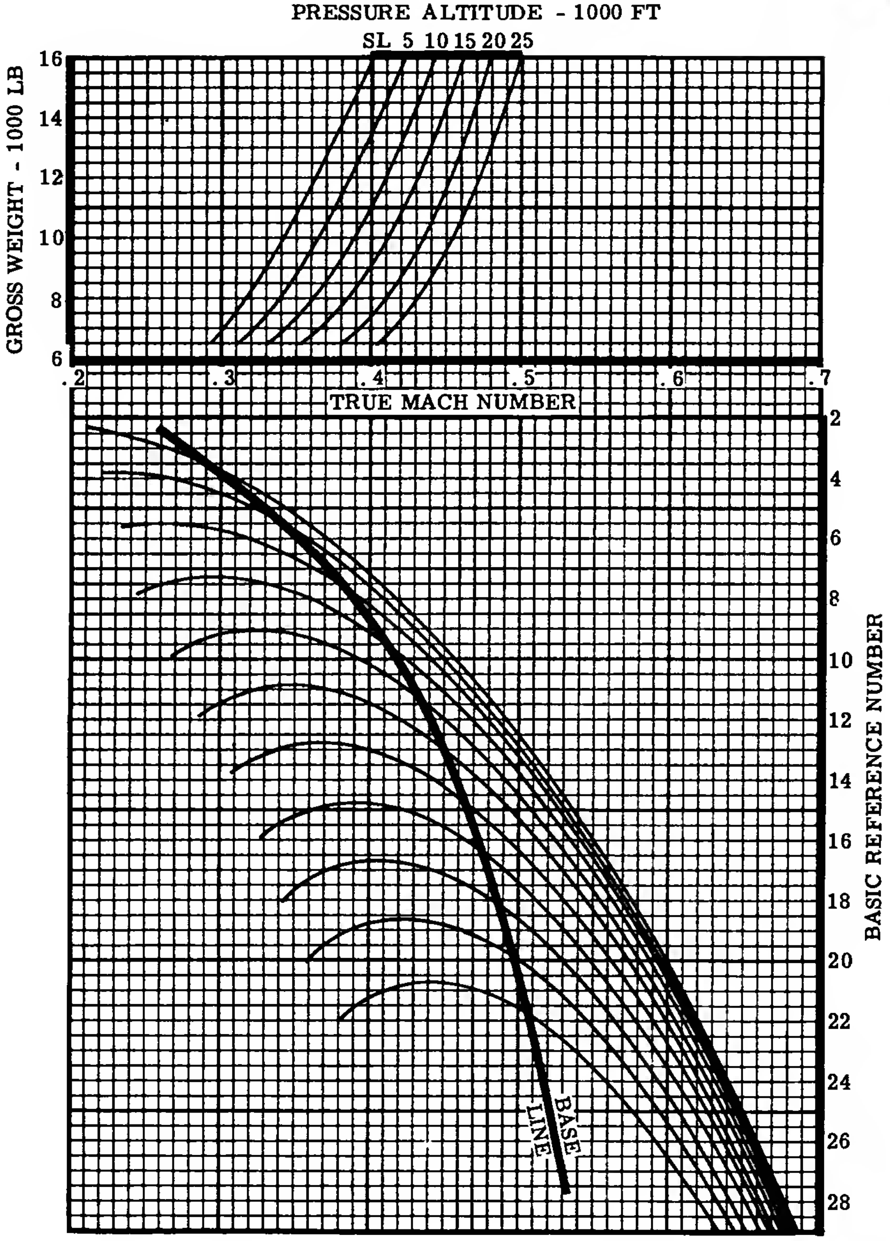


Figure A4-8 (Sheet 1 of 4)

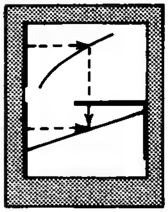
CRUISE DATA

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

TWO ENGINES

CORRECTION OF BASIC REFERENCE NUMBER
FOR EXTERNAL STORES



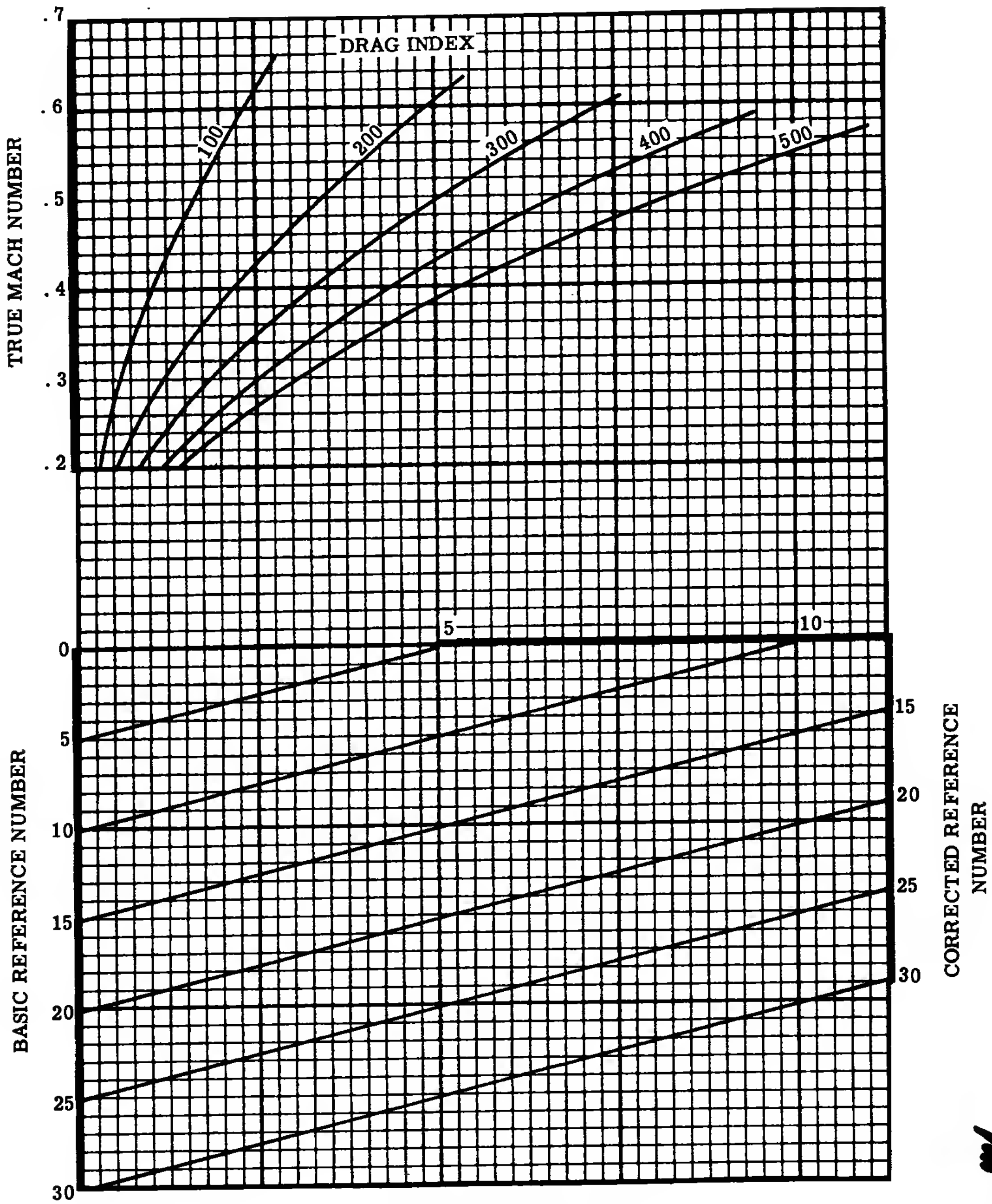


Figure A4-8 (Sheet 2 of 4)

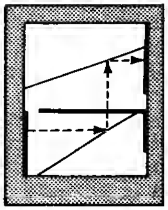
CRUISE DATA

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

TWO ENGINES

AIR NAUTICAL MILES PER POUND OF FUEL



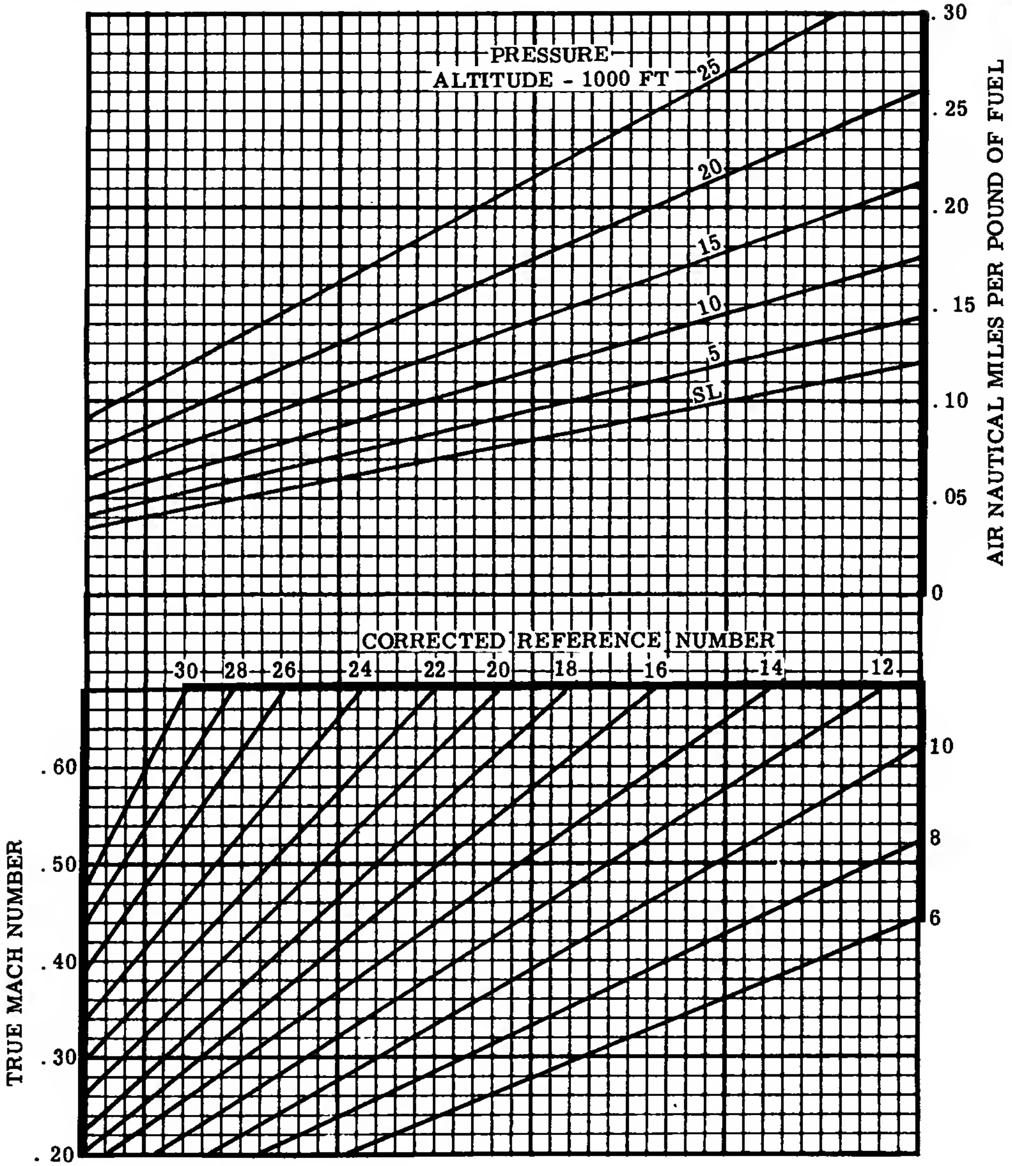


Figure A4-8 (Sheet 3 of 4)

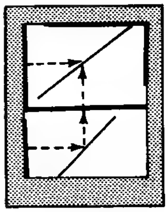
CRUISE DATA

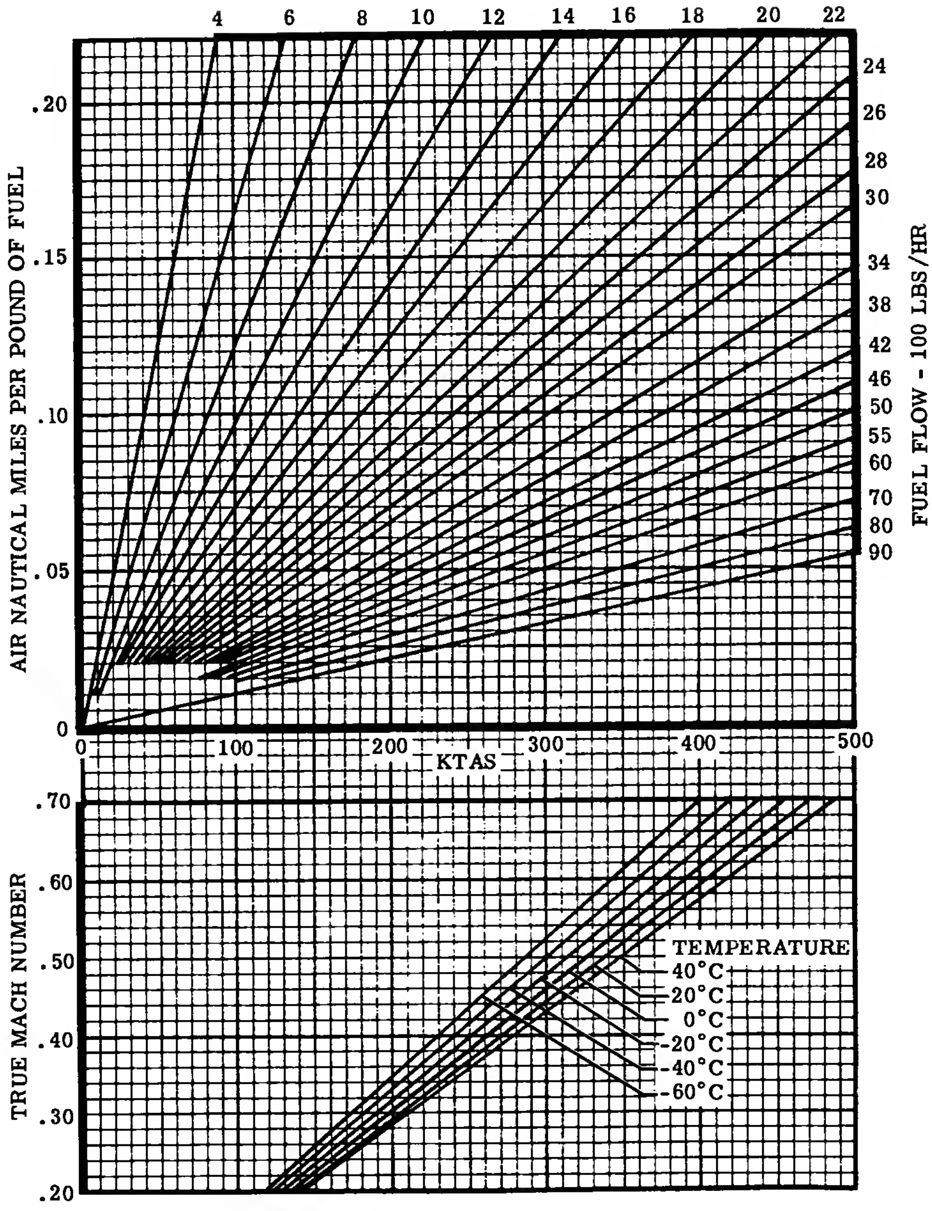
MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

TWO ENGINES

FUEL FLOW AND TRUE AIRSPEED

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL





ALTITUDE	0 FT	5000 FT	10,000 FT	15,000 FT	20,000 FT	25,000 FT
STANDARD TEMPERATURE	15°C	5°C	-5°C	-15°C	-25°C	-35°C

Figure A4-8 (Sheet 4 of 4)

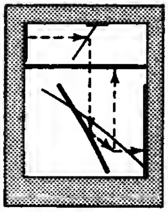
CRUISE DATA

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (1) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

SINGLE ENGINE

MACH NUMBER AND BASIC REFERENCE NUMBER



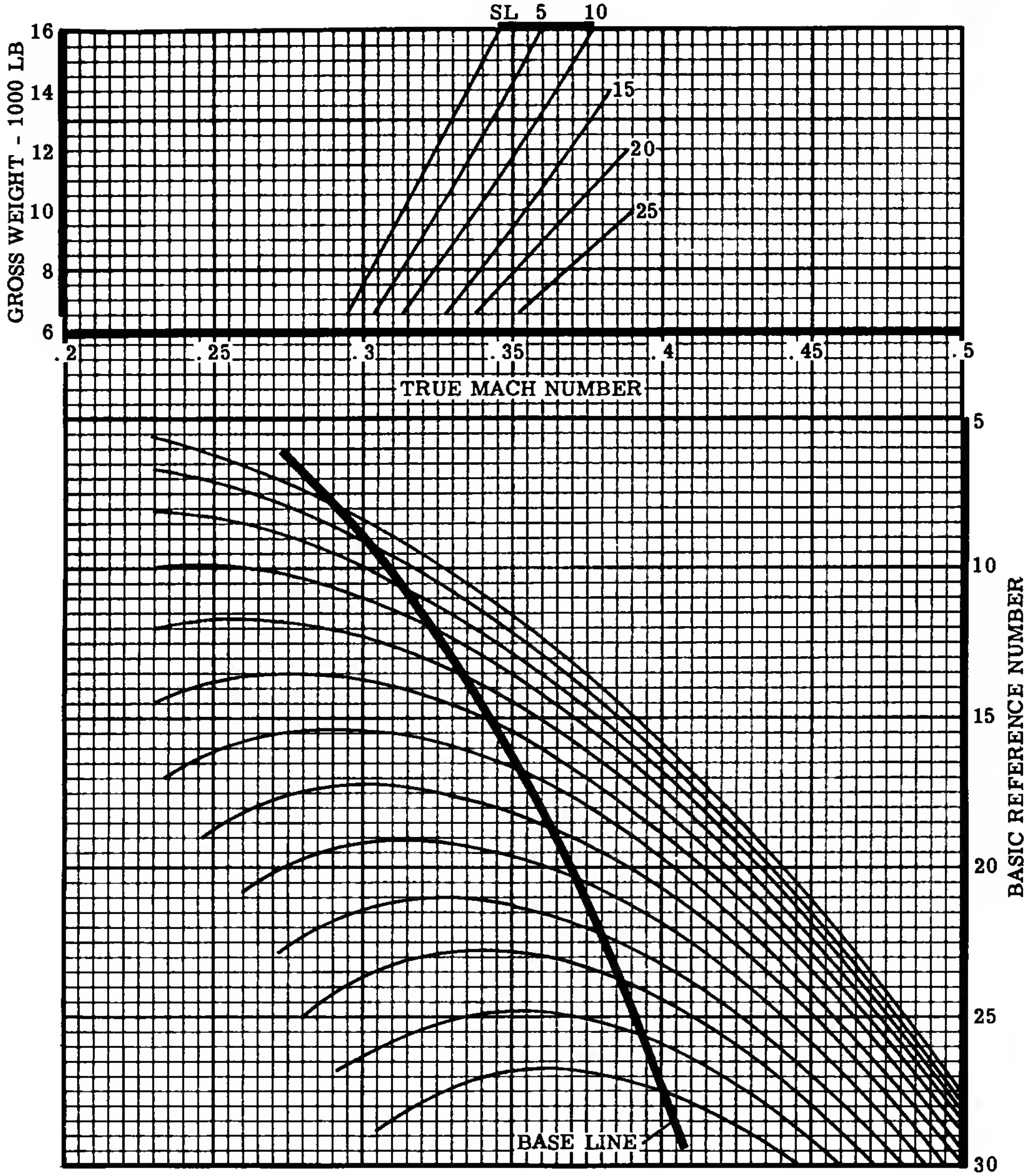


Figure A4-9 (Sheet 1 of 4)

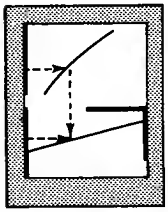
CRUISE DATA

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (1) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

SINGLE ENGINE

CORRECTION OF BASIC REFERENCE NUMBER
FOR EXTERNAL STORES



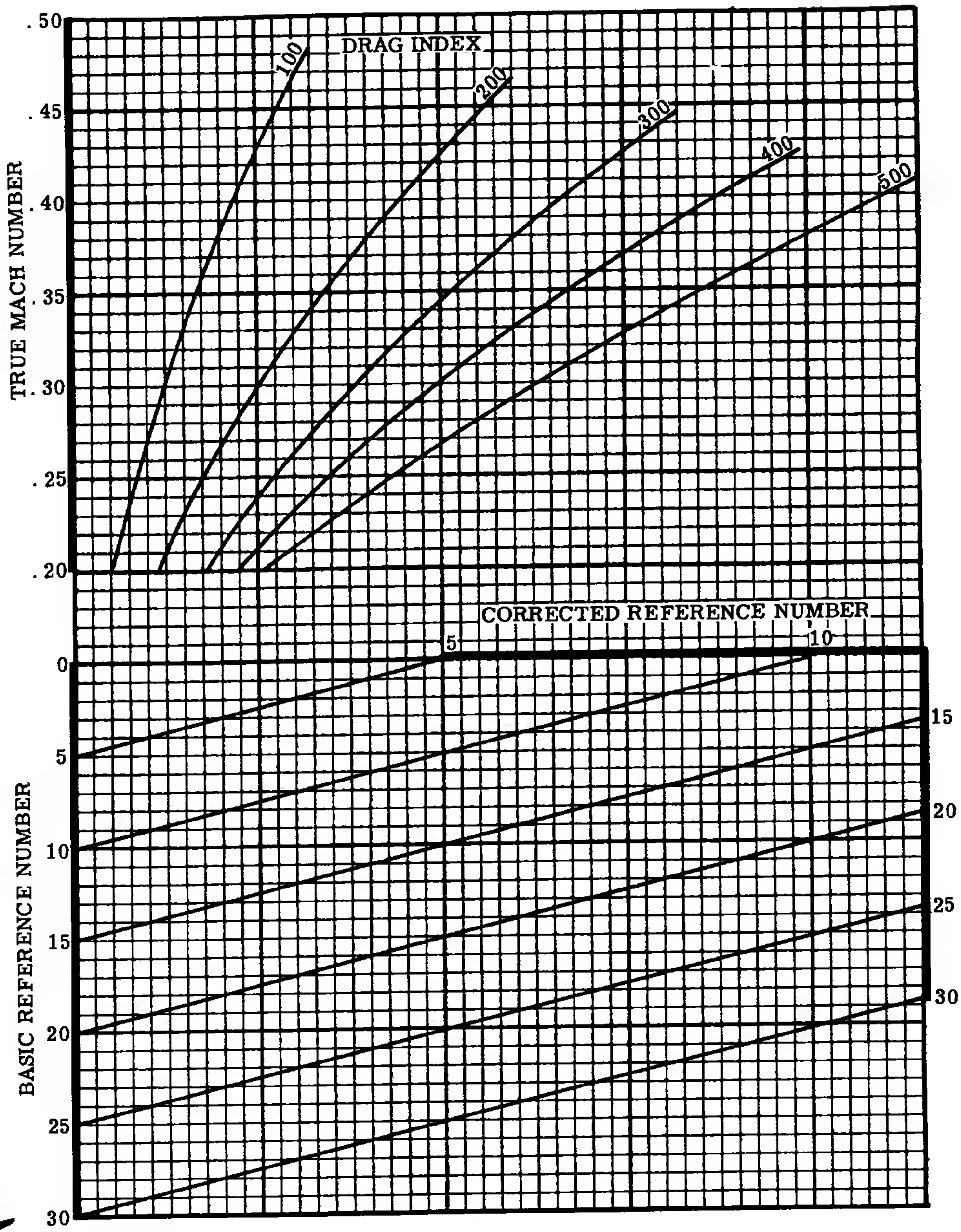


Figure A4-9 (Sheet 2 of 4)

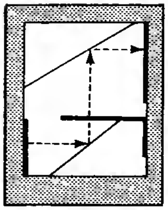
CRUISE DATA

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (1) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

SINGLE ENGINE

AIR NAUTICAL MILES PER POUND OF FUEL



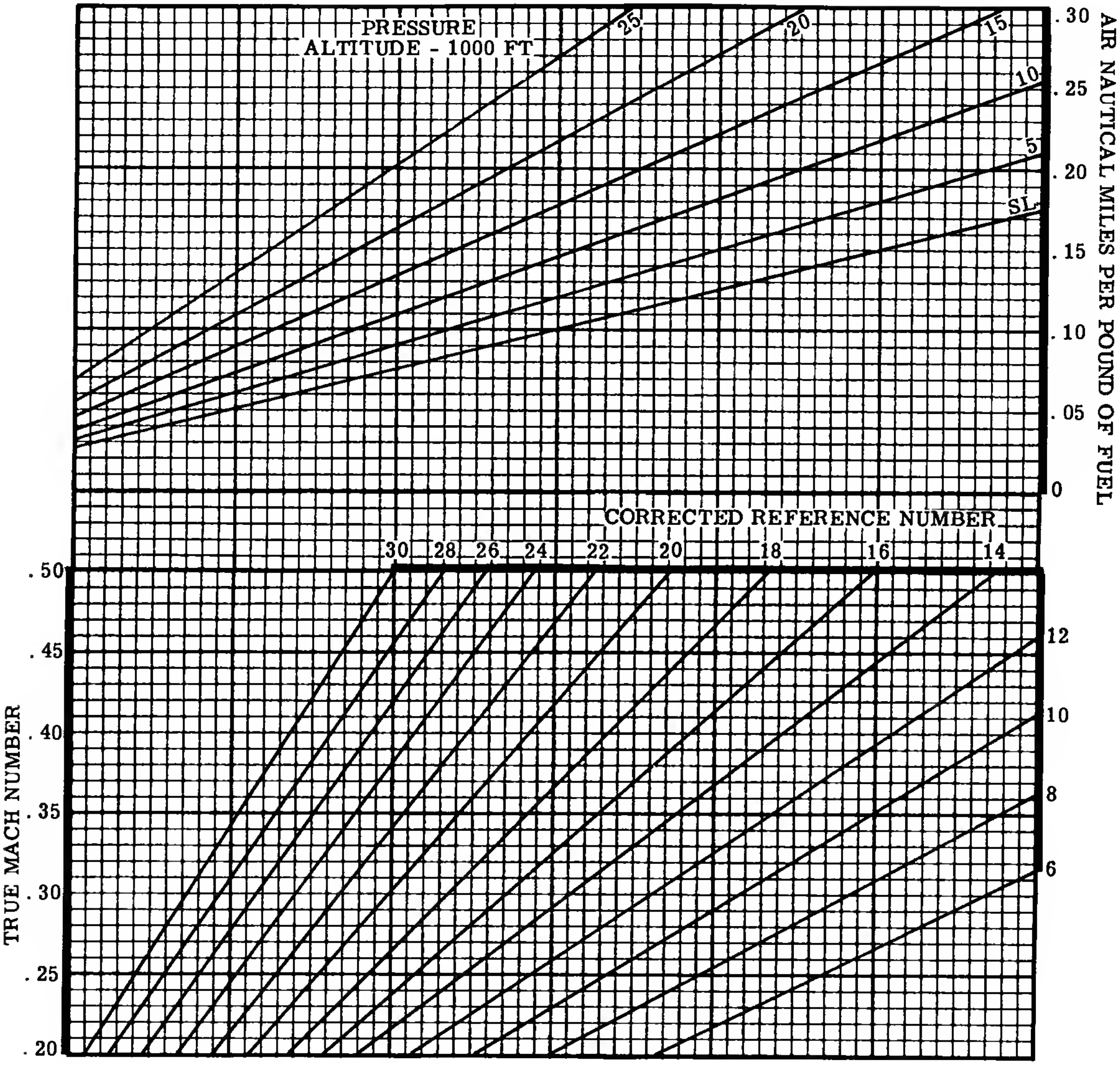
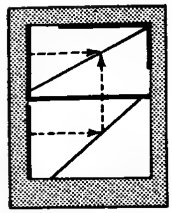


Figure A4-9 (Sheet 3 of 4)

CRUISE DATA

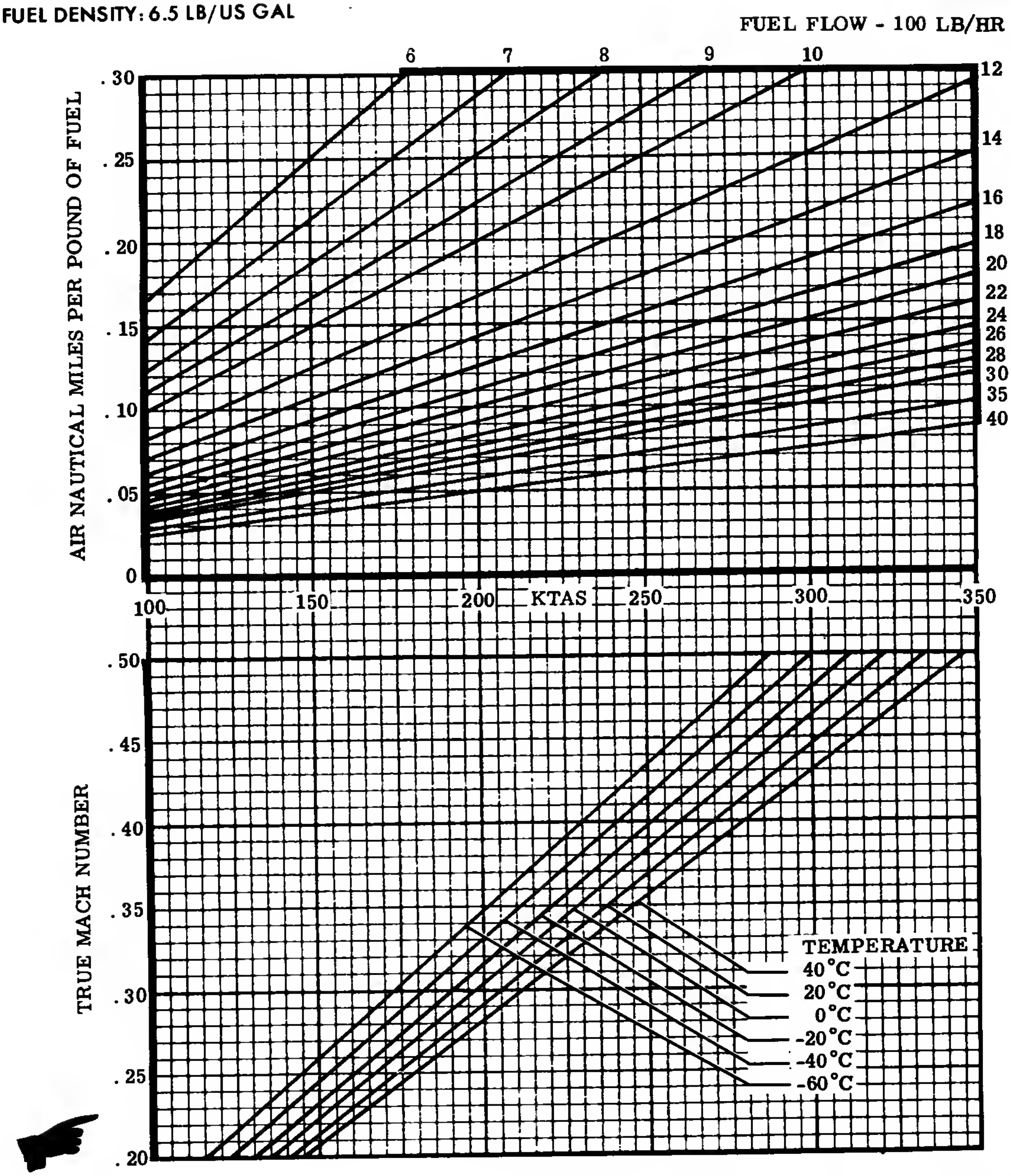


MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

SINGLE ENGINE

FUEL FLOW AND TRUE AIRSPEED

STANDARD DAY
ENGINES: (1) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



ALTITUDE	0 FT	5000 FT	10,000 FT	15,000 FT	20,000 FT	25,000 FT
STANDARD TEMPERATURE	15°C	5°C	-5°C	-15°C	-25°C	-35°C

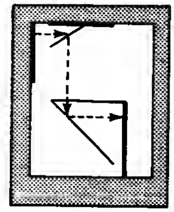
Figure A4-9 (Sheet 4 of 4)

OPTIMUM CRUISE ALTITUDE CHART

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

TWO ENGINES

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



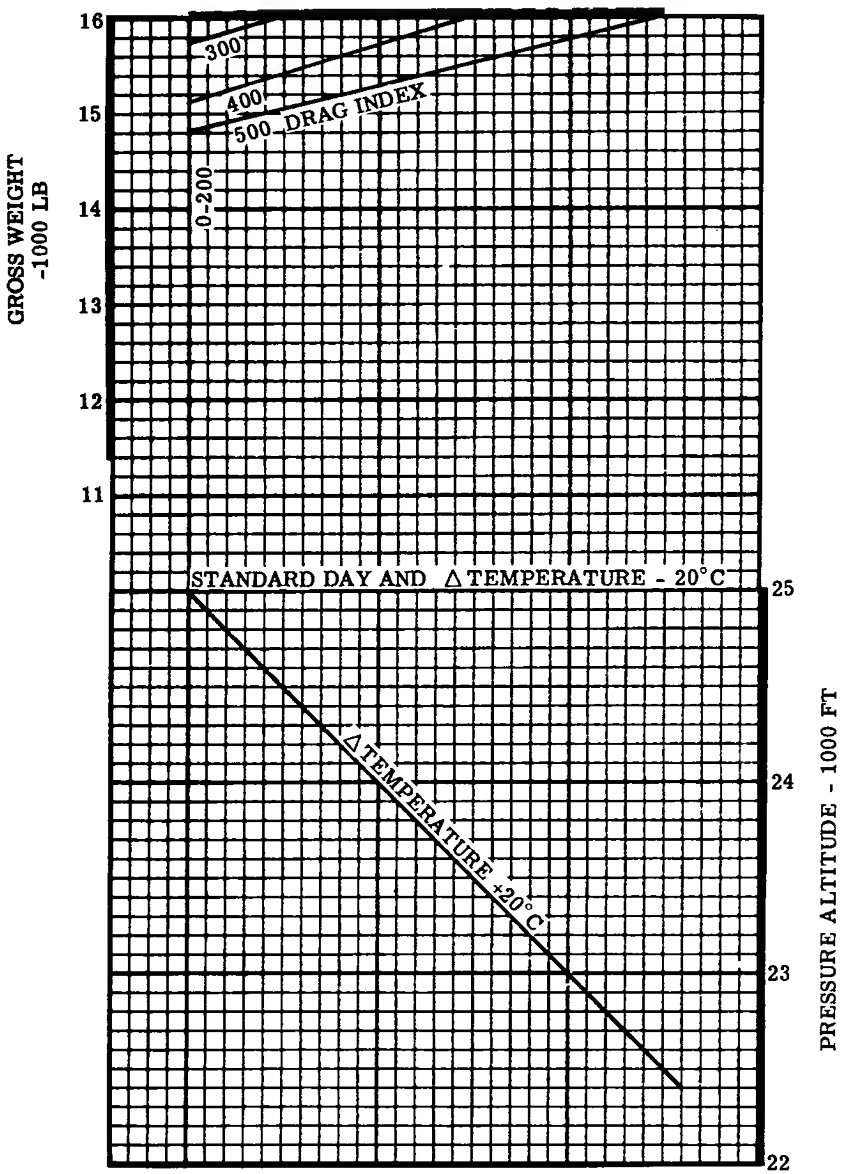
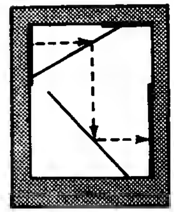


Figure A4-10 (Sheet 1 of 2)

OPTIMUM CRUISE ALTITUDE CHART



MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

SINGLE ENGINE

STANDARD DAY
ENGINES: (1) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

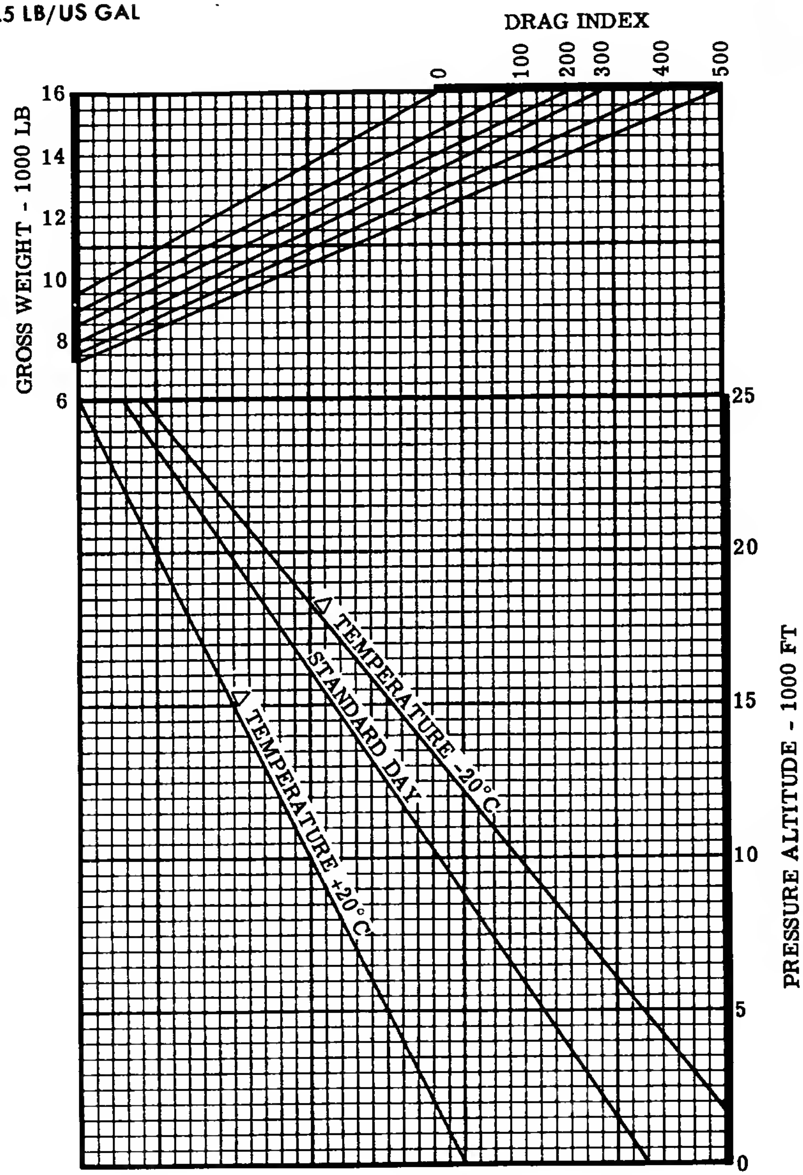


Figure A4-10 (Sheet 2 of 2)

OPTIMUM CRUISE ALTITUDE FOR SHORT RANGE MISSIONS CHART

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

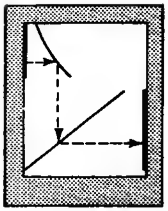
STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

MAXIMUM THRUST CLIMB

99% MAXIMUM RANGE - SPEED

ON COURSE

TWO ENGINES



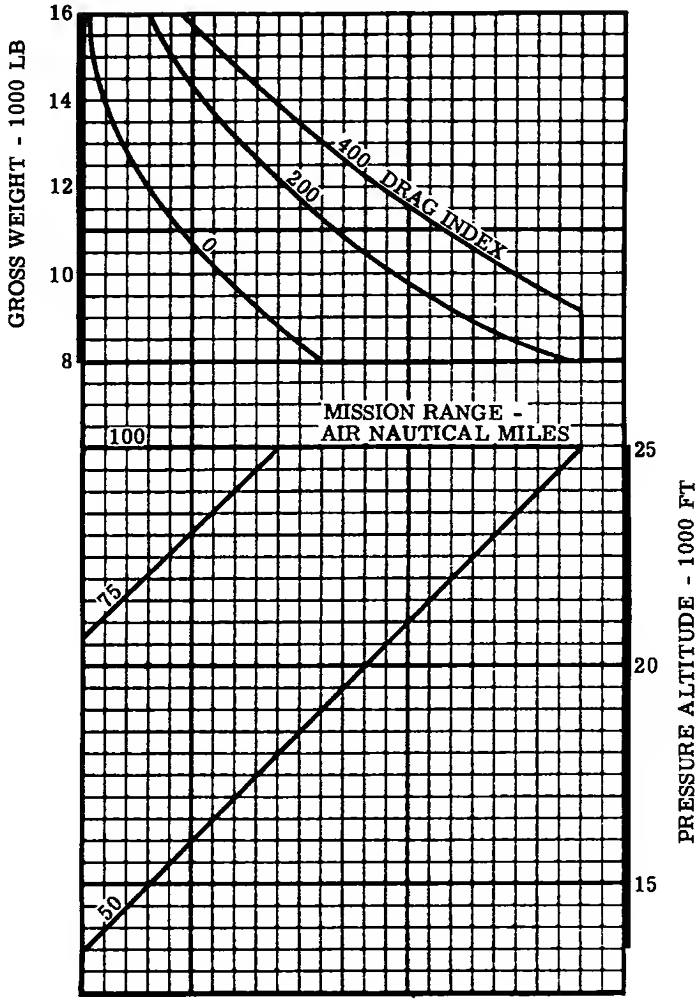


Figure A4-11

DIVERSION RANGE SUMMARY TABLE

SINGLE ENGINE

TWO PYLON TANKS

STANDARD DAY

ZERO WIND

FUEL AND RANGE REMAINING WITH 300 LB RESERVE AT SEAL LEVEL								PROCEDURE
FUEL	1000 FT	SL	5	10	15	20	25	INITIAL ALTITUDE
600 LB	NMI	41	52	64	75	86	95	A CRUISE AT INITIAL ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
	1000 FT	15	15	15	20	20	25	OPTIMUM ALTITUDE
	NMI	48	58	67	76	86	95	B CRUISE AT OPTIMUM ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
800 LB	NMI	68	83	100	116	131	144	A CRUISE AT INITIAL ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
	1000 FT	20	20	20	20	20	25	OPTIMUM ALTITUDE
	NMI	88	100	111	121	131	144	B CRUISE AT OPTIMUM ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
1000 LB	NMI	94	114	135	156	176	192	A CRUISE AT INITIAL ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
	1000 FT	25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI	132	145	157	169	178	192	B CRUISE AT OPTIMUM ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
CRUISE ALT CRUISE KCAS		SL 194	5 183	10 172	15 162	20 153	25 146	
DESCENT C	NMI REMAINING		10	19	27	34	39	
	FUEL REMAINING		329	348	361	370	376	

A FUEL AND DISTANCE INCLUDED FOR DESCENT TO DESTINATION.

B FUEL AND DISTANCE INCLUDED FOR CLIMB TO OPT. ALT. AND DESCENT TO DESTINATION.

C DESCENT DATA TABULATED FOR IDLE RPM AND SPEED BRAKE (SB) IN.

NOTE: CLIMB AT 194 KCAS LESS 2 KNOTS PER 1000 FT ALTITUDE WITH MAXIMUM RPM.

Figure A4-12 (Sheet 1 of 2)

DIVERSION RANGE SUMMARY TABLE

TWO ENGINES

TWO PYLON TANKS

STANDARD DAY

ZERO WIND

FUEL AND RANGE REMAINING WITH 300 LB RESERVE AT SEA LEVEL								PROCEDURE
FUEL	1000 FT	SL	5	10	15	20	25	INITIAL ALTITUDE
600 LB	NMI	31	39	48	55	64	71	△A CRUISE AT INITIAL ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
	1000 FT	15	15	20	25	25	25	OPTIMUM ALTITUDE
	NMI	40	46	52	58	65	71	△B CRUISE AT OPTIMUM ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
800 LB	NMI	51	62	75	88	100	114	△A CRUISE AT INITIAL ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
	1000 FT	25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI	76	84	92	100	107	114	△B CRUISE AT OPTIMUM ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
1000 LB	NMI	72	87	102	119	137	155	△A CRUISE AT INITIAL ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
	1000 FT	25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI	117	125	133	141	148	155	△B CRUISE AT OPTIMUM ALTITUDE AND DESCEND ON COURSE; DESCENT - 200 KCAS, SB - IN, IDLE RPM.
CRUISE ALT		SL	5	10	15	20	25	
CRUISE KCAS		234	222	211	201	192	183	
DESCENT △C	NMI REMAINING		12	22	30	38	45	
	FUEL REMAINING		367	411	440	460	473	

△A FUEL AND DISTANCE INCLUDED FOR DESCENT TO DESTINATION.

△B FUEL AND DISTANCE INCLUDED FOR CLIMB TO OPT. ALT. AND DESCENT TO DESTINATION.

△C DESCENT DATA TABULATED FOR IDLE RPM AND SPEED BRAKE (SB) IN.

NOTE: CLIMB AT 239 KCAS LESS 2 KNOTS PER 1000 FT ALTITUDE WITH NORMAL POWER (97.9% RPM).

Figure A4-12 (Sheet 2 of 2)

PART V — ENDURANCE

TABLE OF CONTENTS

MAXIMUM ENDURANCE.

These charts (figure A5-1 through A5-2) give maximum endurance Mach number, loiter time available on a given quantity of fuel or fuel required for a given loiter time for any given condition of gross weight, altitude and drag index. The charts are presented for two engine and single engine operation.

USE.

Enter the Mach number chart for the appropriate engine condition with the average gross weight and proceed horizontally right to the proper pressure altitude reflector. Project vertically down and intersect the appropriate drag index. Project horizontally right and read the maximum endurance Mach number. To find the fuel required to loiter for a given time, enter the fuel used chart with the average gross weight and proceed horizontally to the right to the proper altitude reflector. Project vertically downward to the desired loiter time reflector then horizontally to the right to the proper drag index. From the drag index reflector project vertically downward and read the fuel required. If the required fuel indicated results in an appreciably higher average gross weight from the estimated average gross weight, the computation should be reworked using the new gross weight. The loiter time available on a given quantity of fuel is found by entering the chart with the average gross weight and proceeding horizontally to the right to the proper pressure altitude reflector. From the altitude reflector project vertically down through the time portion of the chart. Enter with the loiter fuel to the proper drag index and project horizontally to the left. At the intersection of the altitude projection and the drag index projection read the loiter time available.

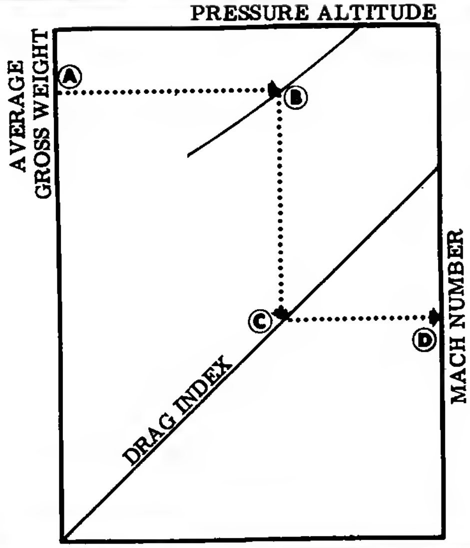
SAMPLE PROBLEM.

Given:
1. Two engine operation = 20, 000 ft.
2. Average gross weight = 11, 000 lb.
3. Drag index = 400
4. Fuel available = 1500 lb.

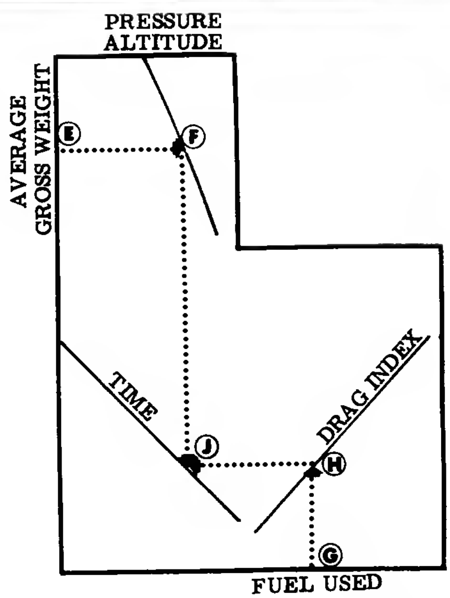
Find loiter Mach number and loiter time available:

A.	Average gross weight	11, 000 lb.
B.	Pressure altitude	20, 000 ft.
C.	Drag index	400
D.	Mach number	0. 286
E.	Average gross weight	11, 000 lb.
F.	Pressure altitude	20, 000 ft.
G.	Fuel available	1500 lb.
H.	Drag index	400
J.	Loiter time available on 1500 lb. of fuel	59 min.

SAMPLE MAXIMUM ENDURANCE MACH NUMBER CHART (two engine)



SAMPLE MAXIMUM ENDURANCE FUEL USED CHART (two engine)



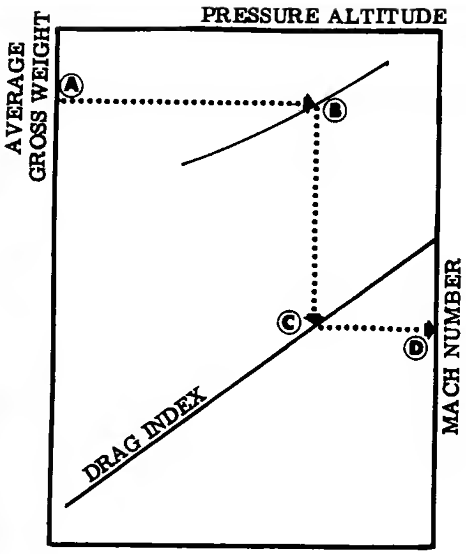
SAMPLE PROBLEM.

Given:
1. One engine operation = 15, 000 ft.
2. Average gross weight = 10, 500 lb.
3. Drag index = 100
4. Desired loiter time = one hour

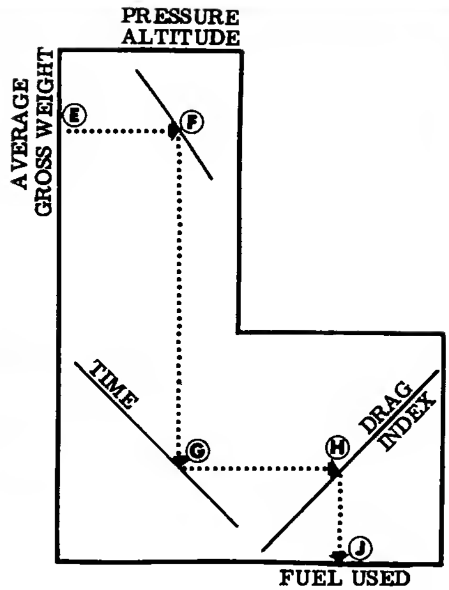
Find loiter Mach number and fuel required:

A.	Average gross weight	10, 500 lb.
B.	Pressure altitude	15, 000 ft.
C.	Drag index	100
D.	Loiter Mach number	0. 286
E.	Average gross weight	10, 500 ft.
F.	Pressure altitude	15, 000 ft.
G.	Desired loiter time	1:00 hr.
H.	Drag index	100
J.	Fuel required to loiter one hour	1220 lb.

SAMPLE MAXIMUM ENDURANCE MACH NUMBER CHART (single engine)



SAMPLE MAXIMUM ENDURANCE FUEL USED CHART (single engine)

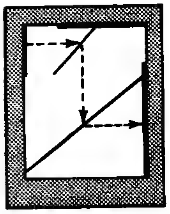


MAXIMUM ENDURANCE - MACH NUMBER CHART

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

TWO ENGINES

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



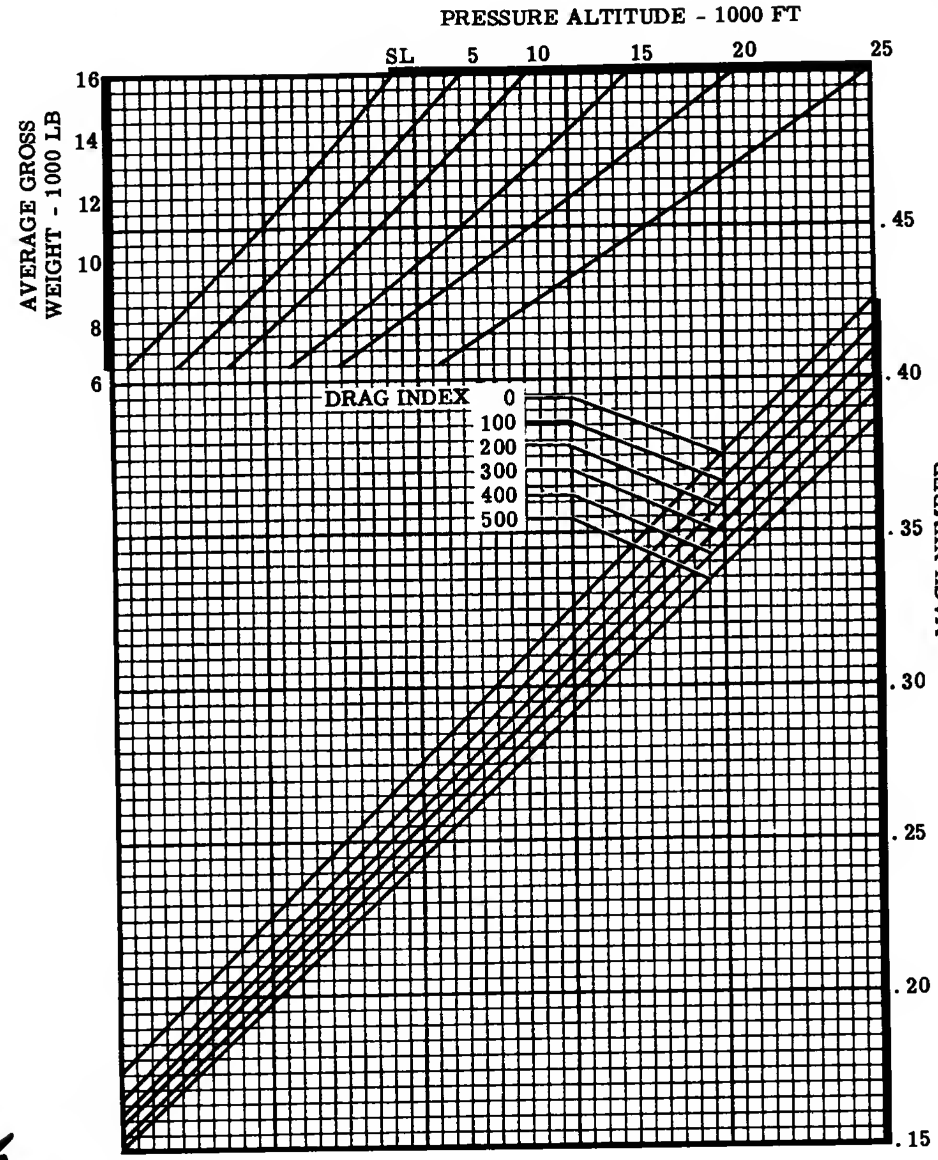
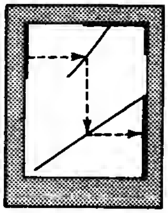


Figure A5-1 (Sheet 1 of 2)

MAXIMUM ENDURANCE - MACH NUMBER CHART

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

SINGLE ENGINE



STANDARD DAY
ENGINES: (1) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

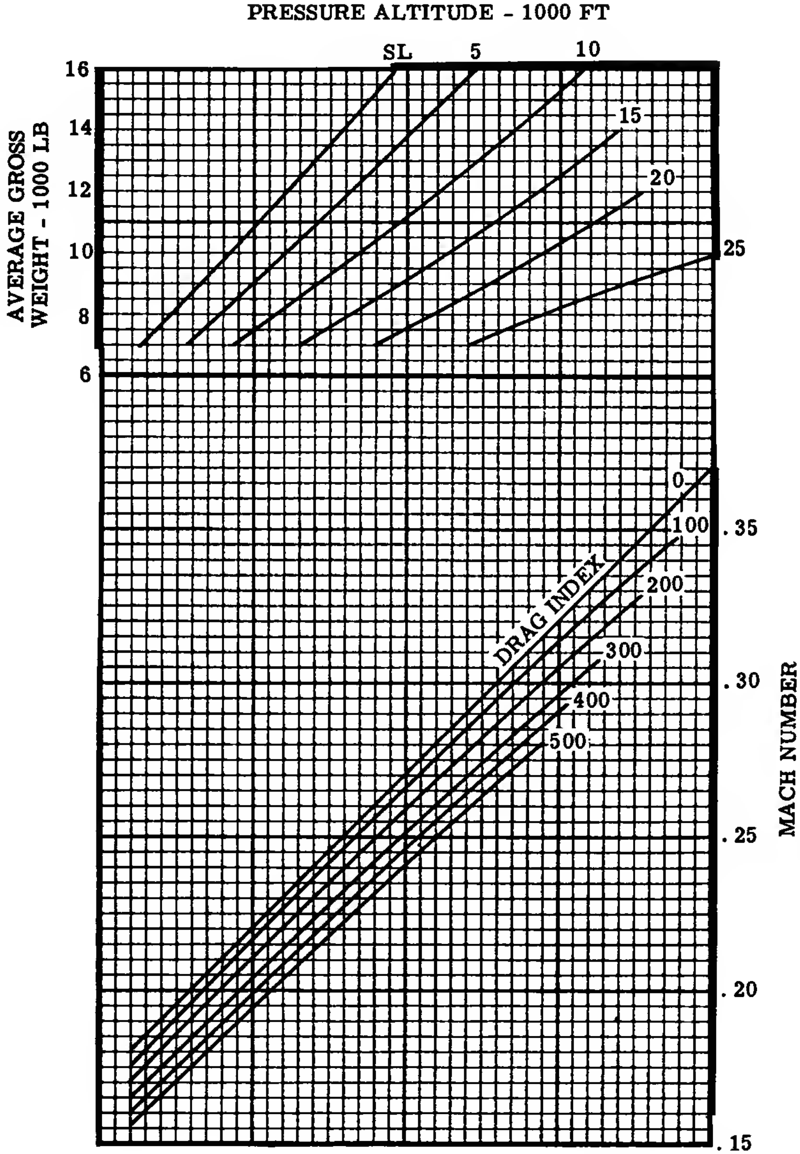


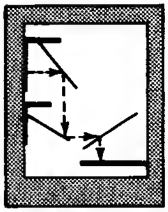
Figure A5-1 (Sheet 2 of 2)

MAXIMUM ENDURANCE - FUEL USED CHART

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

TWO ENGINES

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



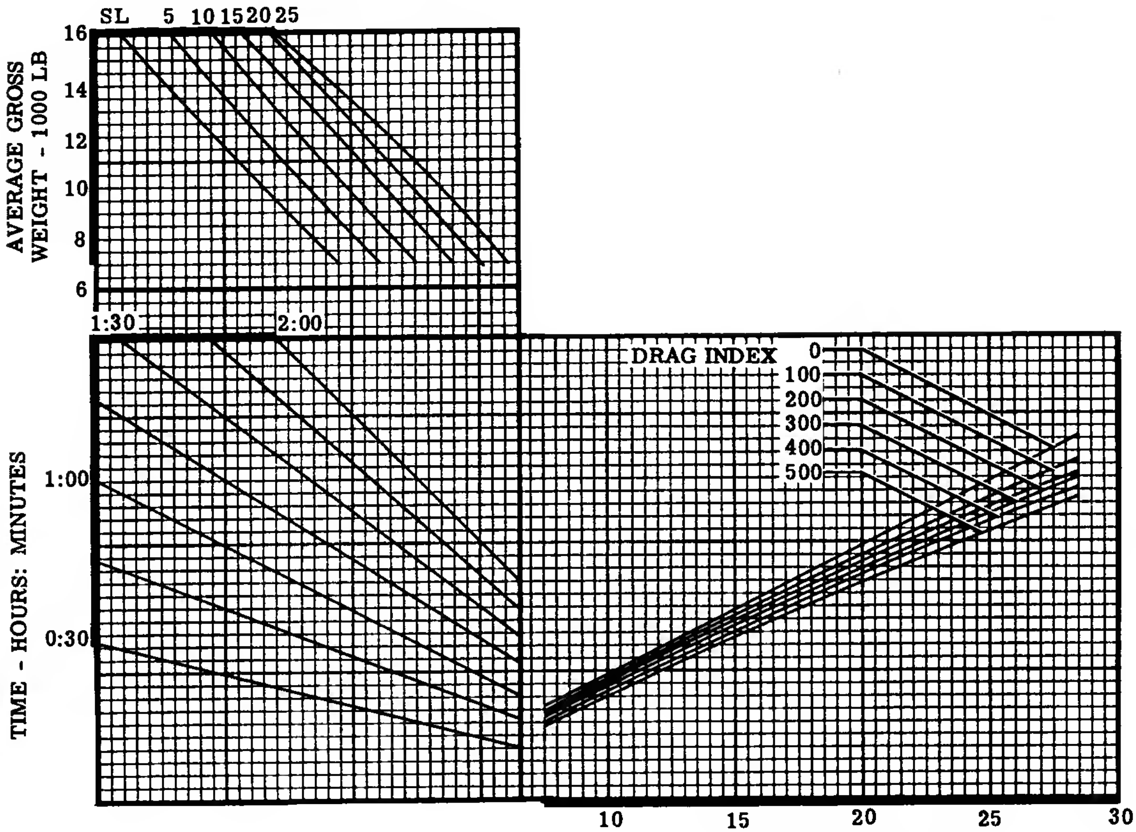
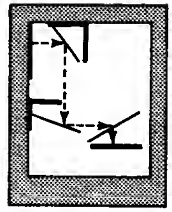


Figure A5-2 (Sheet 1 of 2)

MAXIMUM ENDURANCE - FUEL USED CHART

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

SINGLE ENGINE



STANDARD DAY
ENGINES: (1) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

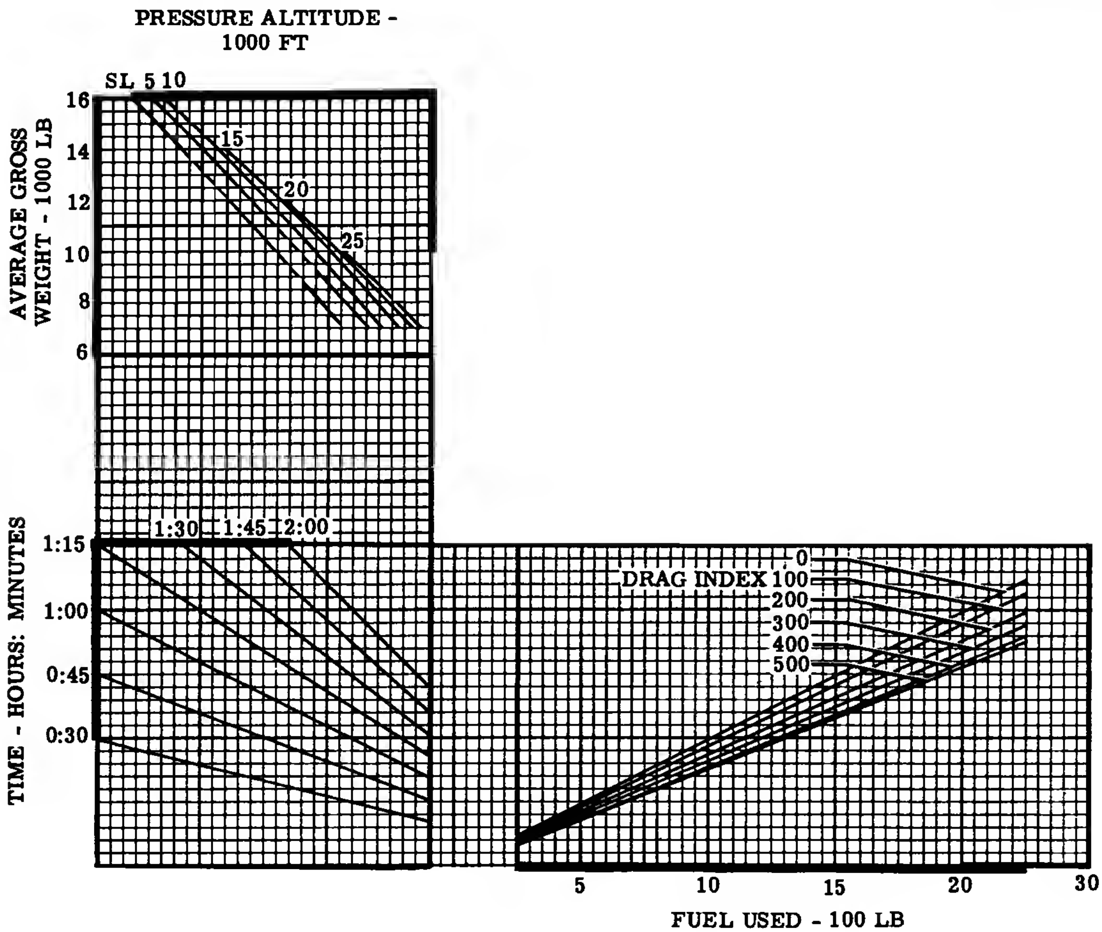


Figure A5-2 (Sheet 2 of 2)

PART VI — COMBAT ALLOWANCE

TABLE OF CONTENTS

COMBAT ALLOWANCE.

This chart (figure A6-1) gives the combat time available on a given amount of fuel or the fuel required for a given amount of combat time. The chart is good for all weights and drag indexes, with inlet screens up and operating at 90% rpm.

USE.

To find the combat time available on a given amount of fuel enter the chart with the pressure altitude and proceed horizontally to the right to the proper fuel used reflector. From the fuel used project vertically downward and read combat time available on that amount of fuel. The fuel required for a specified combat time is found at the intersection of a horizontal projection from the pressure altitude and vertical projection from the combat time.

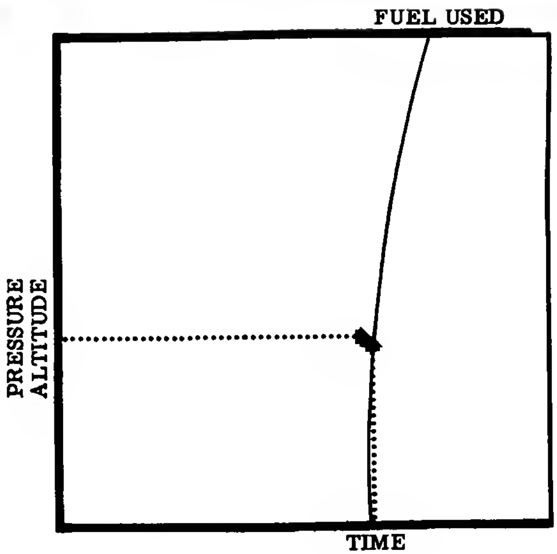
SAMPLE PROBLEM.

Given:
1. Pressure altitude = 3000 ft.
2. 25 minutes of combat

Find fuel required:

A.	Pressure altitude	3000 ft.
B.	Time in combat	25 min.
C.	Fuel required	1180 lb.

SAMPLE COMBAT ALLOWANCE CHART



COMBAT ALLOWANCE CHART

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

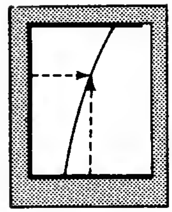
STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

90% RPM

INLET SCREENS UP

ALL WEIGHTS

ALL DRAG INDEXES



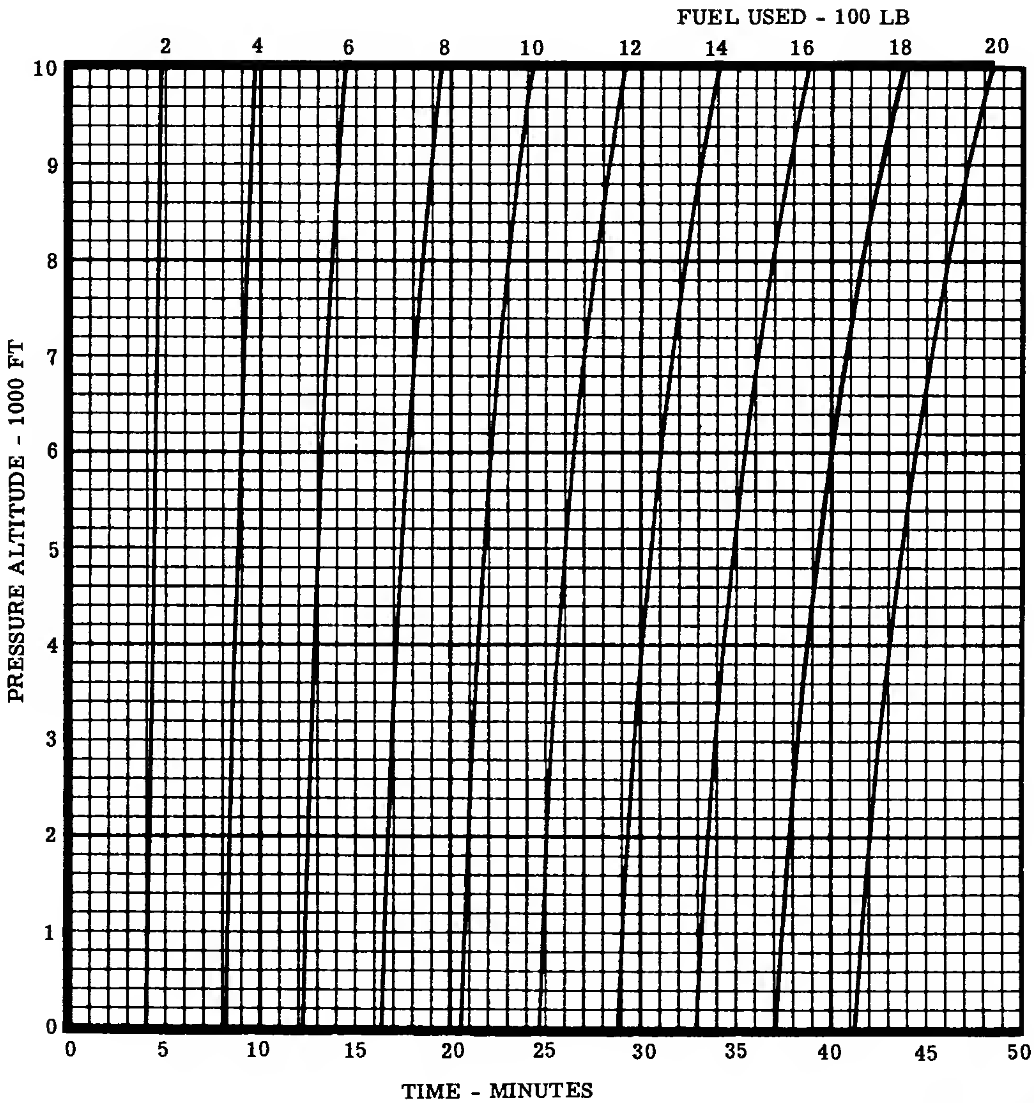


Figure A6-1

PART VII DESCENT

TABLE OF CONTENTS

DESCENT.

Descent performance is presented in figure A7-1. The recommended descent procedure for all weights and configurations is to maintain 200 KCAS at flight idle RPM with the speed brake retracted. The chart presents the time, distance, and fuel used, to descend from any altitude to sea level.

USE.

Enter the time and distance portion (upper half) of the chart with gross weight and proceed vertically up to the appropriate entry altitude reflector, then horizontally to the right to the proper drag index reflector. Proceed vertically down and read the time to descend. From the drag index reflector intersection, continue to project horizontally to the right to the next drag index reflector then project vertically down and read the distance. Enter the fuel used portion, (lower half) with gross weight and proceed vertically up to the appropriate altitude reflector, then horizontally to the right to the drag index reflector. Proceed vertically down and read fuel used.

SAMPLE PROBLEM.

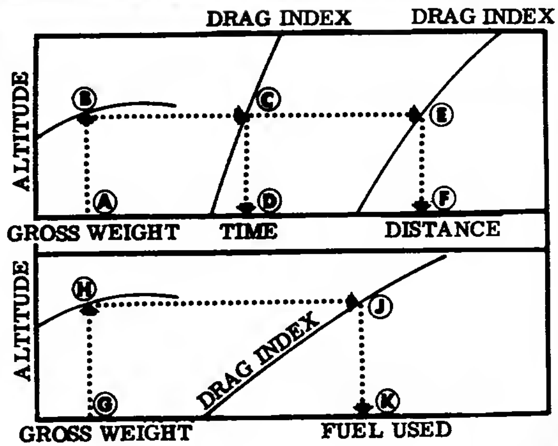
Given:

1. Gross weight = 10, 000 lb.
2. Drag index = 200
3. Entry altitude = 15, 000 ft.

Find the distance covered, elapsed time and fuel used in descent:

A.	Gross weight	10, 000 lb.
B.	Entry altitude	15, 000 ft.
C.	Drag index	200
D.	Time to descent	6. 8 min.
E.	Drag index	200
F.	Distance covered during descent	26 N. mi.
G.	Gross weight	10, 000 lb.
H.	Entry altitude	15, 000 ft.
J.	Drag index	200
K.	Fuel used in descent	118 lb.

DESCENT CHART



DESCENT CHART

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

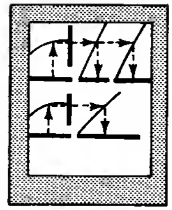
STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

TWO ENGINES

FLIGHT IDLE RPM

SPEED BRAKE RETRACTED

200 KCAS



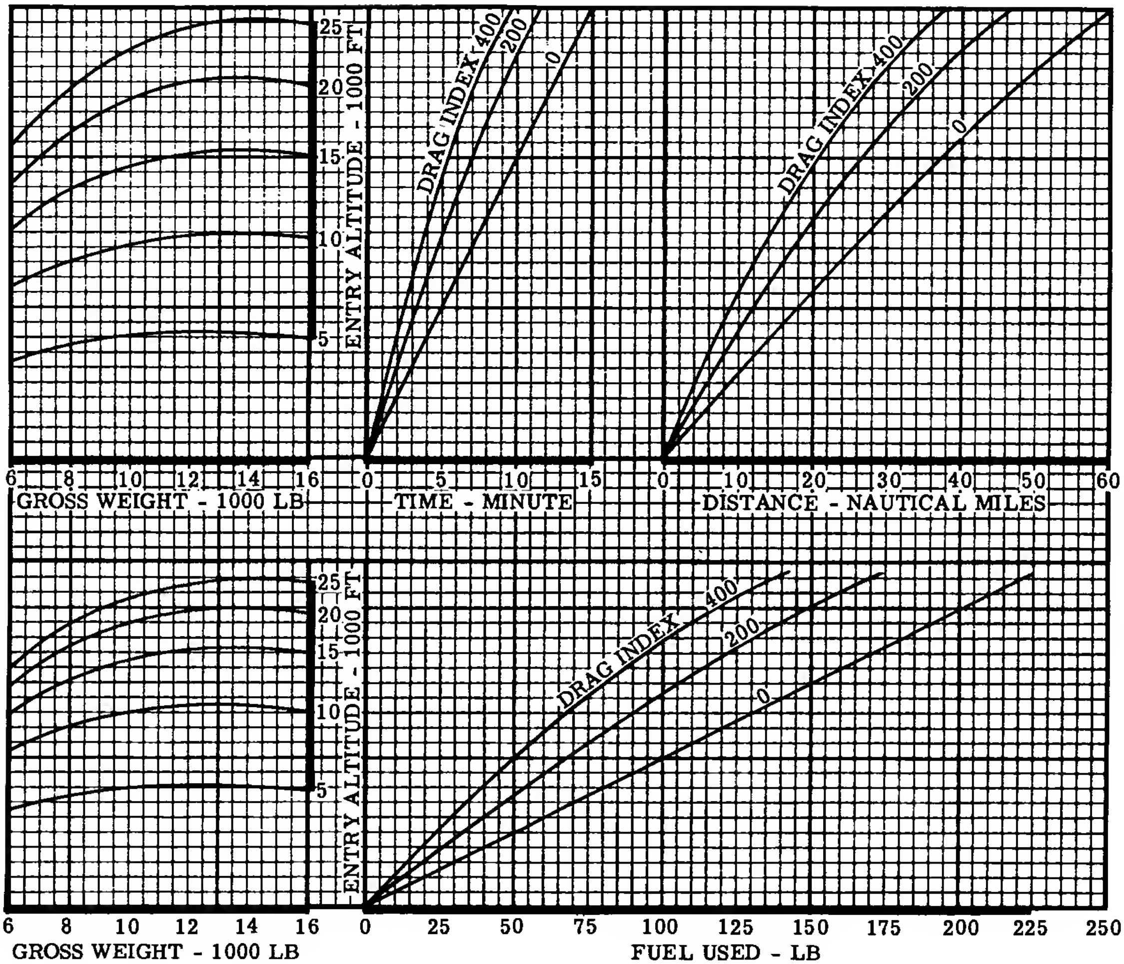


Figure A7-1

MAXIMUM RANGE DESCENT

MODEL: A-37B
DATE: 1 JUNE 1969
DATA BASIS: ESTIMATED

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

FLIGHT IDLE RPM
SPEED BRAKE IN

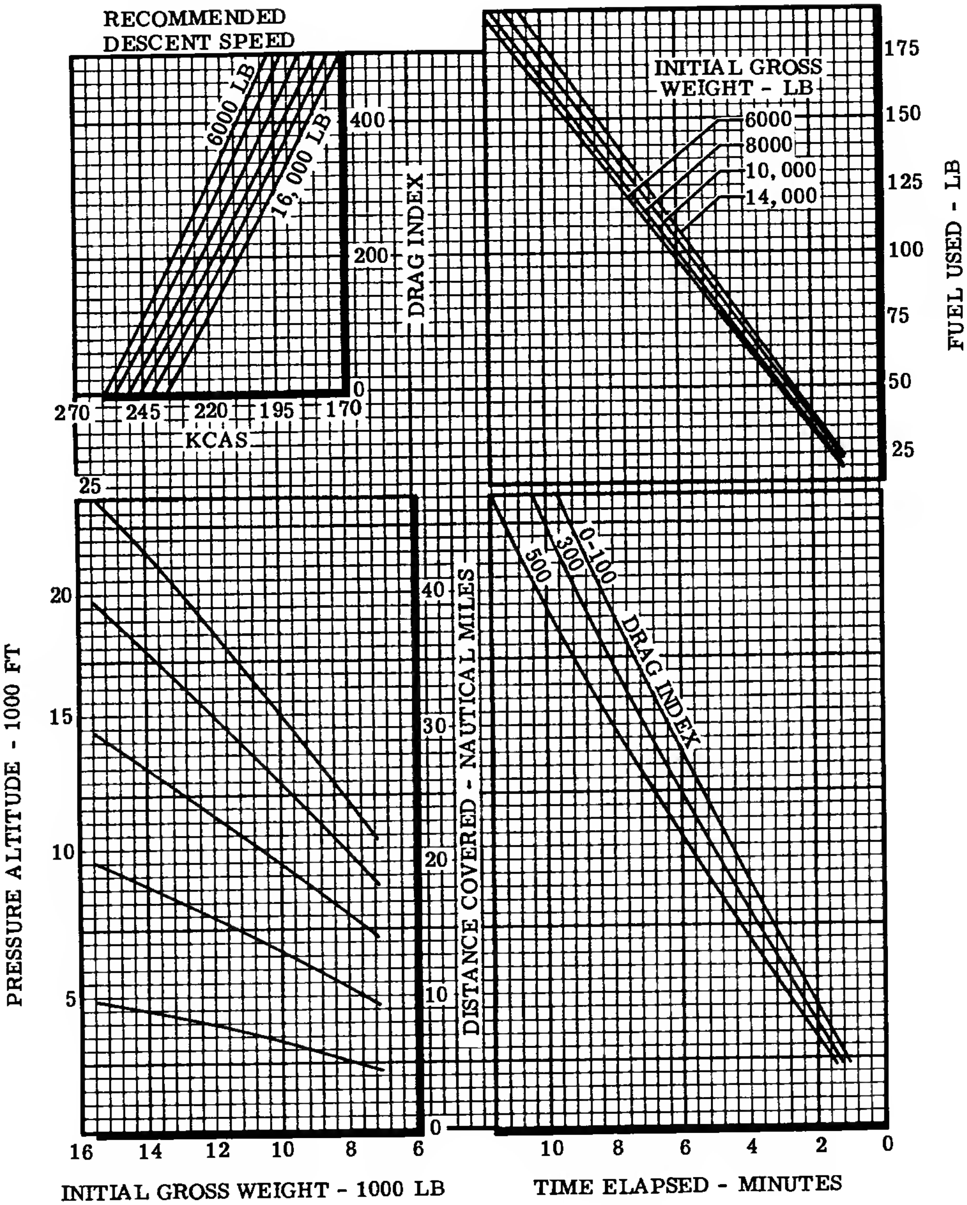
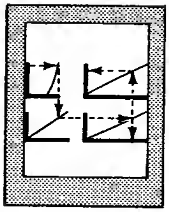


Figure A7-1

PENETRATION DESCENT



MODEL: A-37B
DATE: 1 JUNE 1969
DATA BASIS: ESTIMATED

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

70% RPM
225 KCAS
SPEED BRAKE OUT

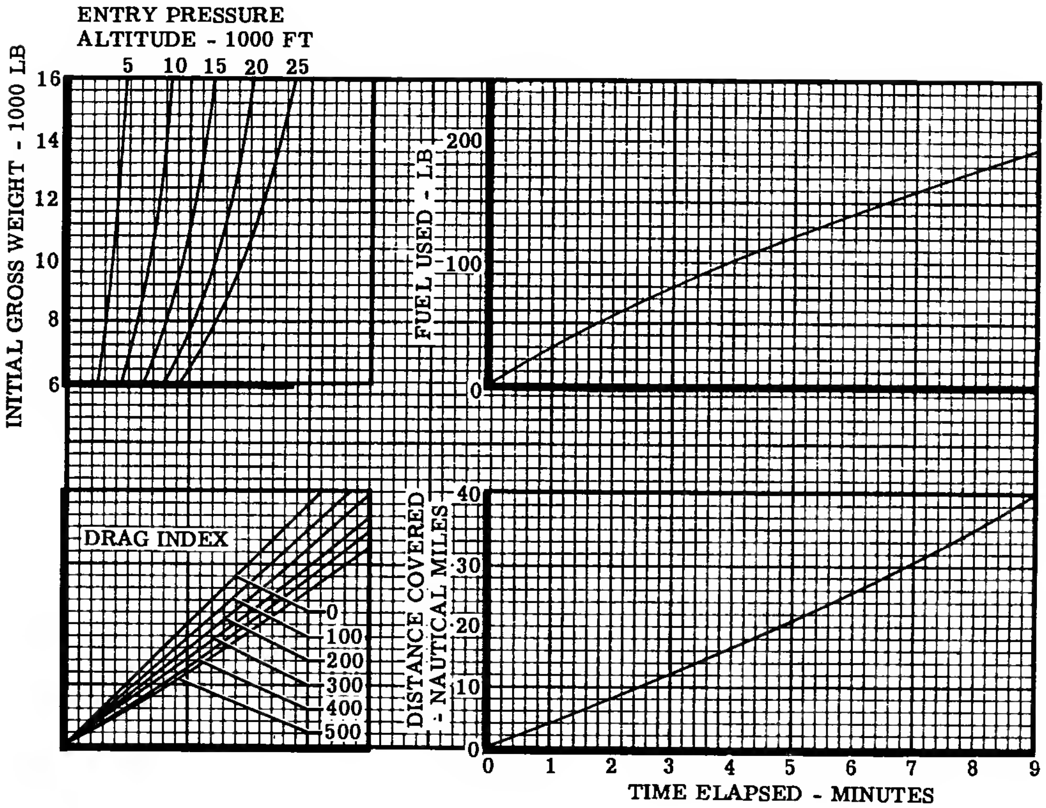
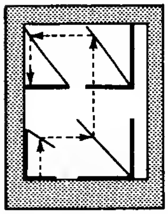


Figure A7-2

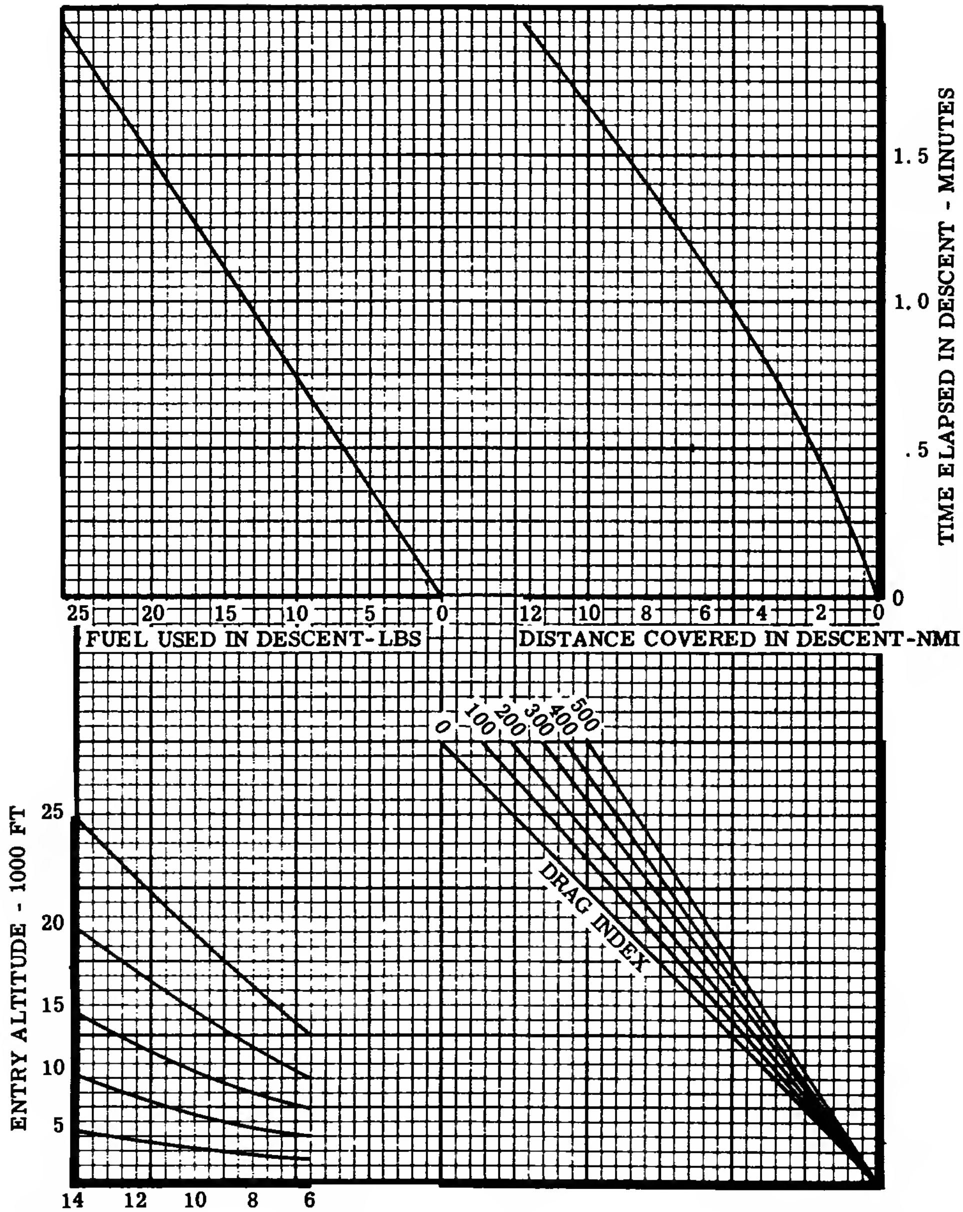
COMBAT DESCENT



MODEL: A-37B
DATE: 15 JANUARY 1968
DATA BASIS: ESTIMATED

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

IDLE RPM
SPEED BRAKE OUT



NOTE RECOMMENDED SPEED IS LIMIT MACH NUMBER (0.7 M) LESS 30 KCAS TO 385 KCAS

Figure A7-3

PART VIII — LANDING

TABLE OF CONTENTS

LANDING SPEED.

The Recommended Landing Speed Chart (figure A8-1) and the Recommended Landing Speed with Hydraulic System Malfunction Chart (figure A8-1A) shows the recommended approach speed at 50 ft. and touchdown (in ground effect) speed for various aircraft gross weights.

USE.

Both landing speed charts are used in the same manner. Enter the chart with the gross weight and project horizontally to the left at each intersection and read the approach speed opposite approach fold line and the touchdown speed opposite the touchdown fold line.

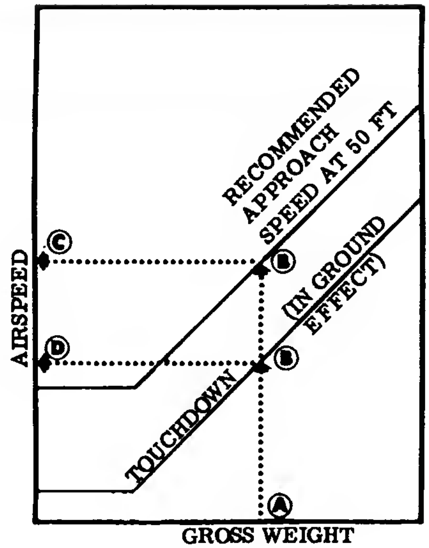
SAMPLE PROBLEM.

Given:
1. Gross weight = 9500 lb.

Find:

A.	Gross weight	9500 lb.
B.	Intersect both fold lines	
C.	Approach speed	113.3 KIAS
D.	Touchdown speed	98.2 KIAS

SAMPLE RECOMMENDED LANDING SPEED CHART



LANDING DISTANCE.

Landing ground roll distance and total landing distance over a 50-foot obstacle are presented in the Normal Landing Distance chart (figure A8-2) and the Landing Distance with Hydraulic System Malfunction chart (figure A8-2A). These distances take into account weight, altitude, temperature and wind velocity. The distances on these charts are good for dry runway conditions (RCR = 23) only.

USE.

Both landing distance charts are used in the same manner. Enter the chart with the proper temperature and project vertically upward to the appropriate pressure altitude reflector. Project horizontally to the right to the appropriate gross weight reflector, then vertically down to the base line. From the base line, follow parallel to the guidelines for headwind or tailwind. Enter with the wind velocity and project horizontally to the right and intersect the headwind or tailwind line above. From this intersection project vertically downward and read the ground roll. Continue this projection to the fold line, then project horizontally to the left and read total distance over a 50-foot obstacle.

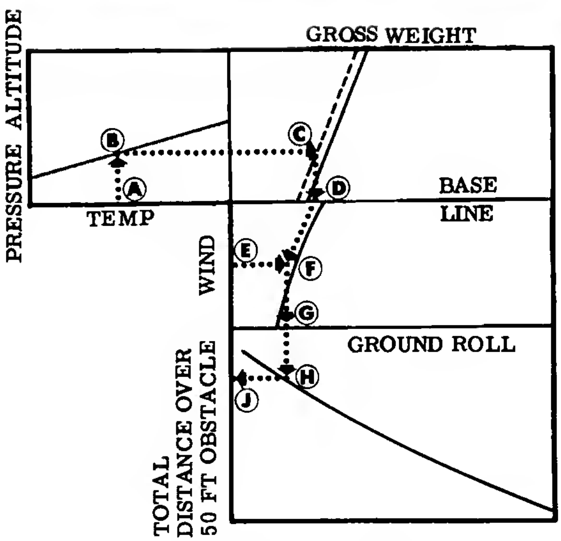
SAMPLE PROBLEM.

Given:
1. Pressure altitude = 2000 ft at 20°C
2. Gross weight = 9500 lb.
3. 20 knot headwind

Find ground roll and total distance over 50-foot obstacle:

A.	Temperature at runway altitude	20°C
B.	Pressure altitude	2000 ft.
C.	Gross weight	9500 lb.
D.	Base line intersection	
E.	Wind velocity	20 Kts.
F.	Headwind intersection	
G.	Ground roll	2200 ft.
H.	Fold line	
J.	Total landing distance	3900 ft.

SAMPLE LANDING DISTANCE CHART



CORRECTION TO LANDING ROLL FOR RUNWAY CONDITION READING (RCR).

When other than dry conditions exist on the active runway, the landing roll must be corrected accordingly. Runway conditions are expressed as Runway Condition Readings (RCR). The RCR value is a measure of the relative slickness of the runway. The higher the RCR value the less slick the runway. A normal dry runway has an RCR of 23, a wet runway an RCR of 12 and an icy runway an RCR of 5. If an exact RCR is not available, use these values. Figure A8-3 corrects the dry runway ground roll to actual ground roll at any RCR.

USE.

Enter the chart with the dry runway ground roll and project vertically upward to the appropriate RCR reflector. Project horizontally to the left and read the corrected ground roll.

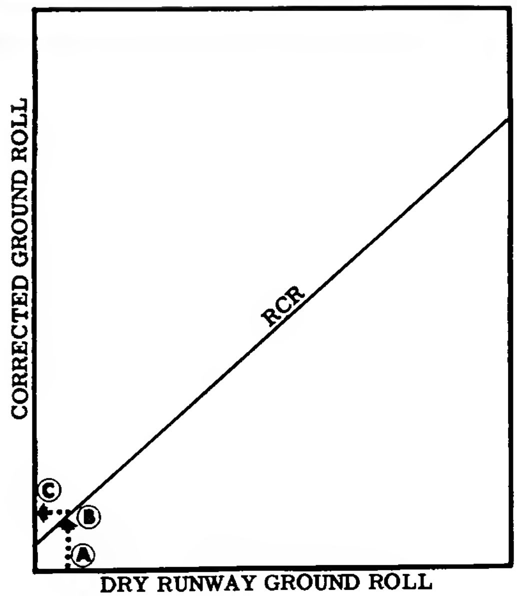
SAMPLE PROBLEM.

Given:
1. Dry runway ground roll = 1000 ft.
2. Runway condition reading (RCR) = 12

Find:

A.	Dry runway ground roll	1000 ft.
B.	RCR	12 (wet)
C.	Corrected ground roll	1800 ft.

SAMPLE CORRECTION TO LANDING GROUND ROLL RCR CHART



RECOMMENDED LANDING SPEED CHART

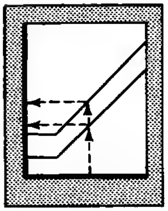
MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

ALL CONFIGURATIONS

SPEED BRAKE EXTENDED

FULL FLAPS



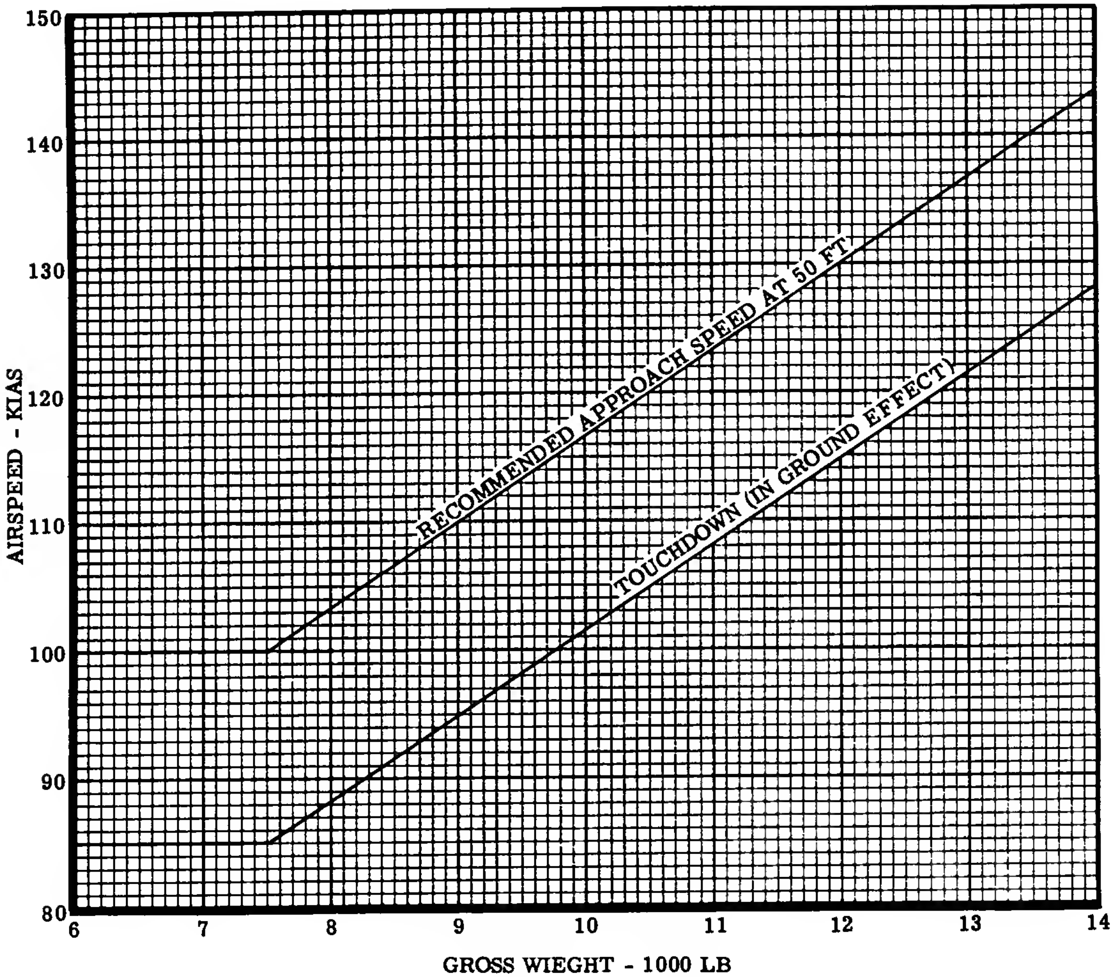
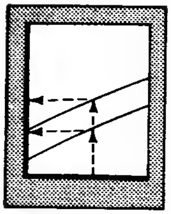


Figure A8-1

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

RECOMMENDED LANDING SPEED WITH HYDRAULIC SYSTEM MALFUNCTION



SPEED BRAKE RETRACTED

THRUST ATTENUATORS RETRACTED

NO FLAPS

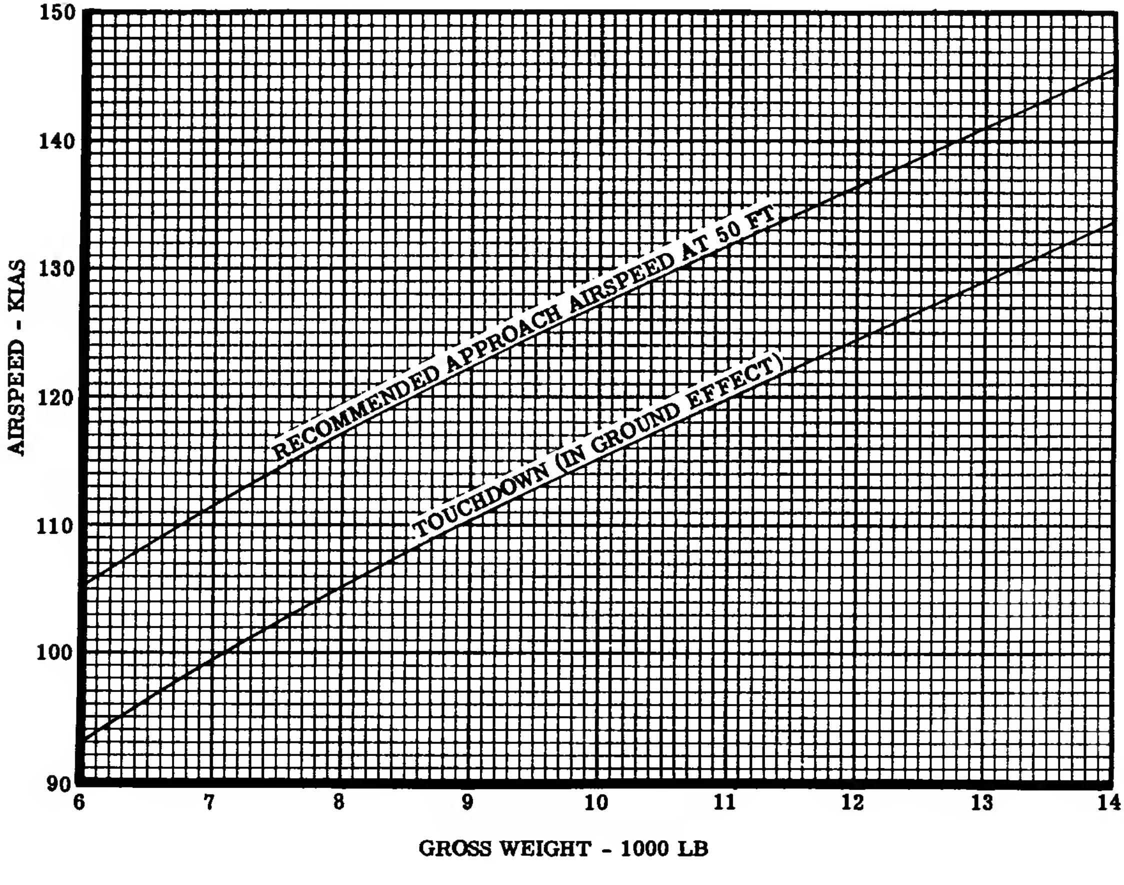


Figure A8-1A

NORMAL LANDING DISTANCE

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

IDLE RPM

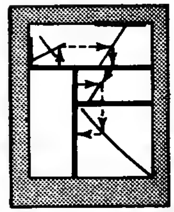
ALL CONFIGURATIONS

SPEED BRAKE EXTENDED

ATTENUATORS EXTENDED

FULL FLAPS

DRY HARD SURFACED RUNWAY



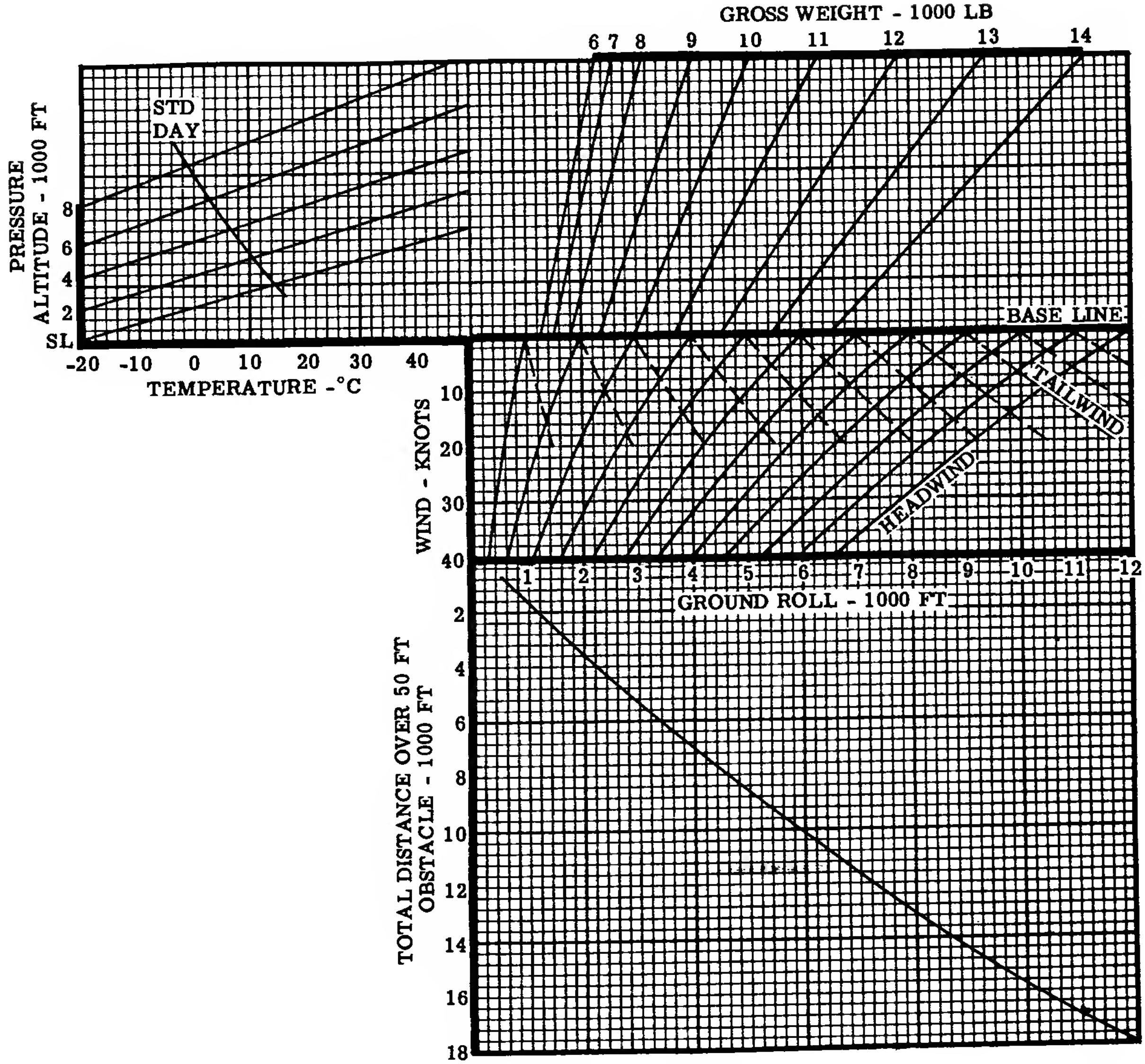


Figure A8-2

LANDING DISTANCE WITH HYDRAULIC SYSTEM MALFUNCTION

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

ALL STORE LOADINGS

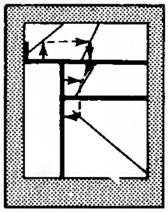
SPEED BRAKE RETRACTED

ATTENUATORS RETRACTED

NO FLAPS

IDLE RPM

DRY HARD SURFACE RUNWAY



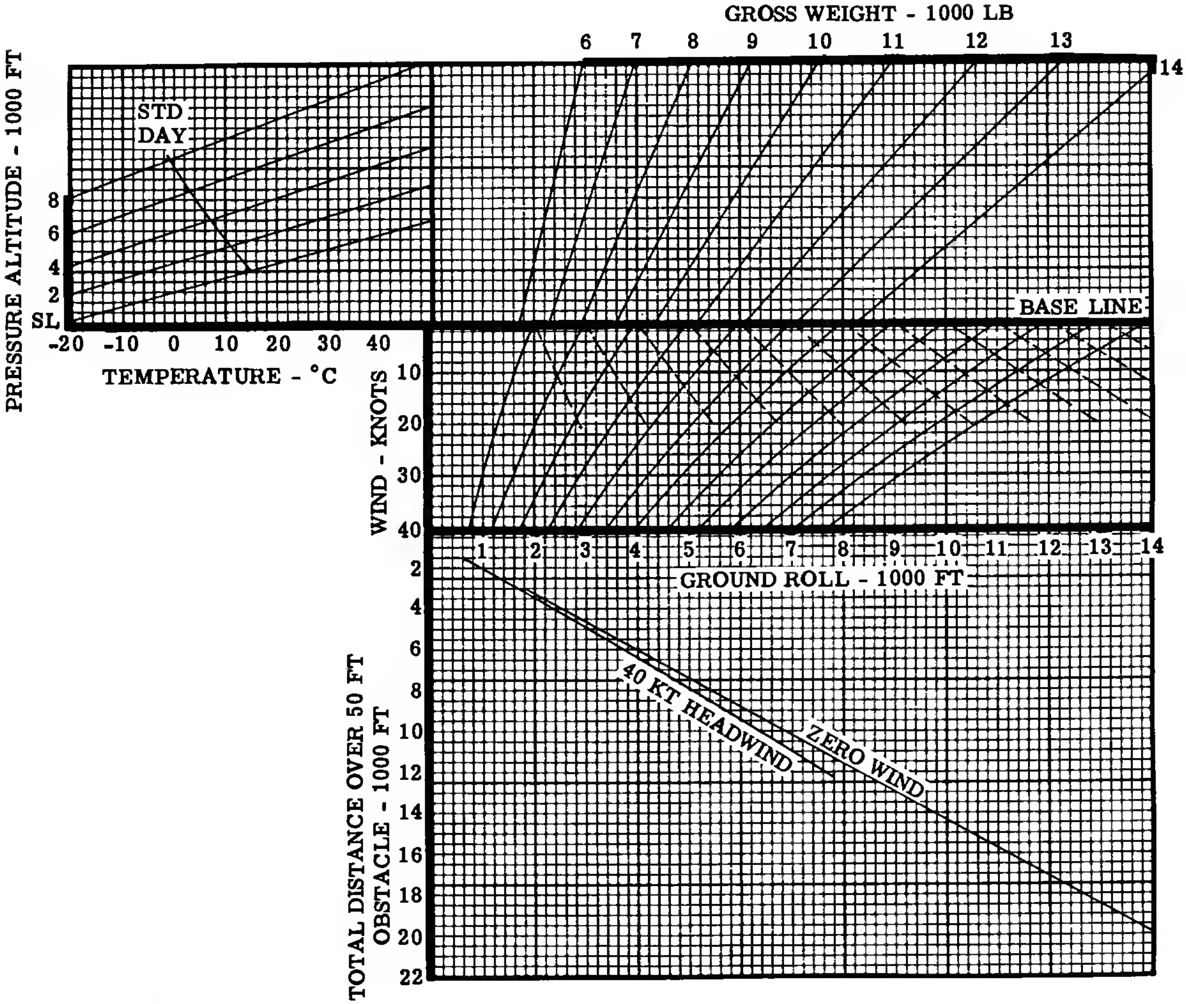
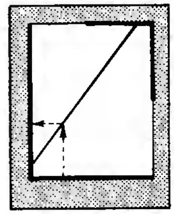


Figure A8-2A

CORRECTION TO LANDING GROUND ROLL FOR RCR

MODEL: A-37B
DATE: 24 JUNE 1969
DATA BASIS: FLIGHT TEST

STANDARD DAY
ENGINES: (2) J85-17A
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



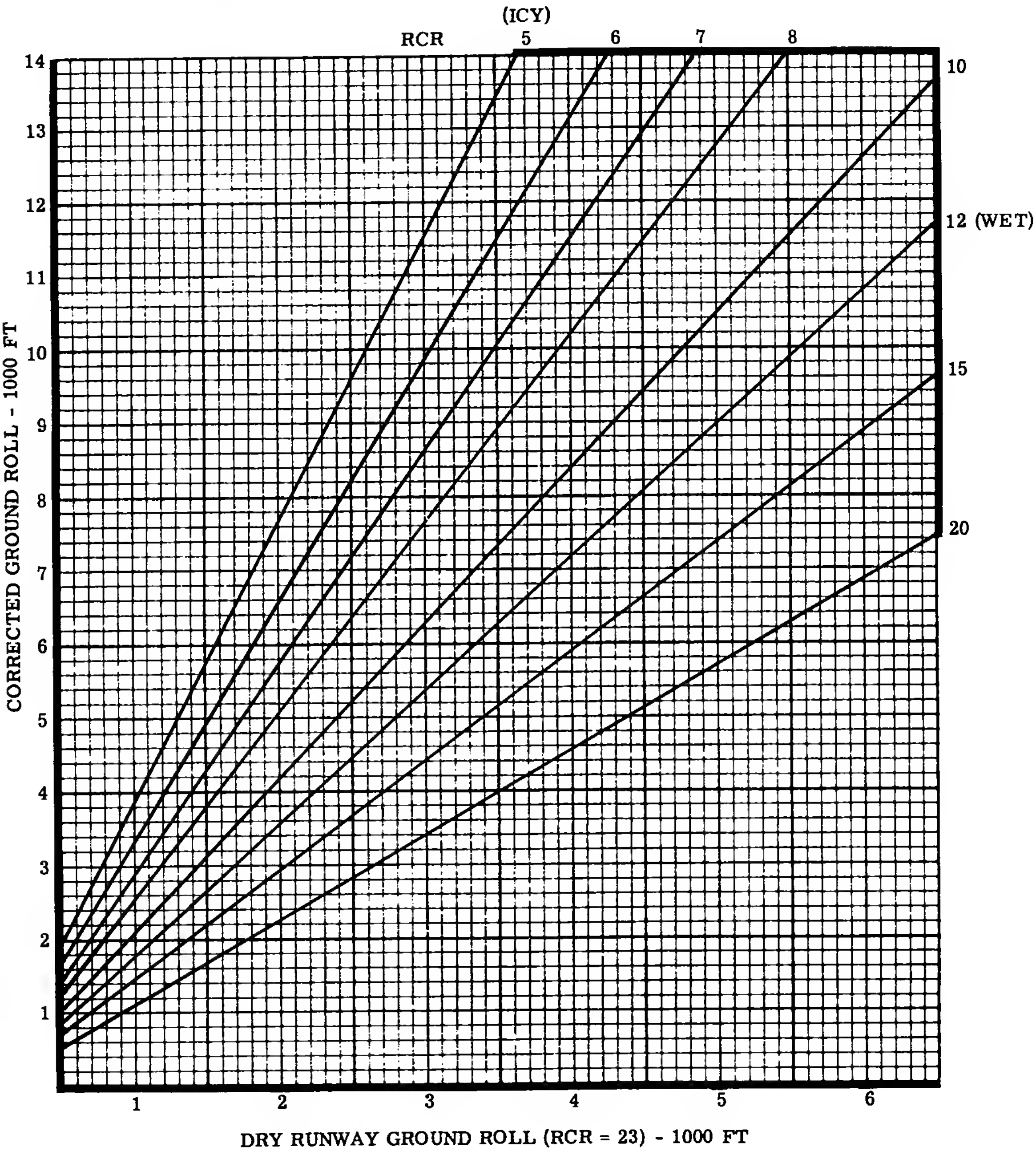


Figure A8-3

PART IX — MISSION PLANNING

TABLE OF CONTENTS

TAKEOFF AND LANDING DATA CARD.

The Takeoff and Landing Data Card is included in the flight crew checklist. The takeoff and landing information for the planned mission should be entered on the data card and used as ready reference for review prior to takeoff and landing. A complete sample problem of a mission, to familiarize the pilot with the use of the charts and procedures to fill out the takeoff and landing data card, is shown at the end of this section.

The Takeoff and Landing Data Card definitions are as follows:

DEFINITIONS:

GROSS WEIGHT:
Gross weight of the aircraft at start of mission in pounds.

RUNWAY AIR TEMPERATURE:
Runway air temperature in degrees centigrade.

FIELD PRESSURE ALTITUDE:
Altimeter reading in feet for dial set at 29. 92 inches of mercury.

EFFECTIVE WIND:
Reported wind condition.

RUNWAY LENGTH:
Usable length of runway in feet.

CRITICAL FIELD LENGTH:
The distance required to accelerate to critical engine failure speed and either stop or continue to takeoff on single engine.

TAKEOFF DATA:

TAKEOFF RUN:
The distance required to accelerate to takeoff speed.

REFUSAL SPEED:
The refusal speed (KIAS) is the maximum speed at which the aircraft can be stopped in the remaining runway length.

BEST ANGLE OF CLIMB FOR ONE ENGINE:
The speed that will result in the maximum angle of climb for single engine conditions.

LANDING DATA:

GROSS WEIGHT:
Gross weight of the aircraft at end of mission in pounds.

MINIMUM TOUCHDOWN SPEED:
The speed at which the aircraft will contact the runway.

LANDING ROLL:
The distance required to decelerate from the touchdown speed to full stop.

SAMPLE PROBLEM.

This mission planning problem is included as an additional aid in the application of the data presented in Appendix I. A typical combat mission will be planned in the succeeding paragraphs and each of the charts will be used in the progress of the flight.

For this mission the following conditions are assumed:

1. The mission is to be a low level strike at a target 130 nautical miles due west of the home field and return. The cruise altitude shall be 25, 000 feet.
2. The weather report over the intended route includes a 25 knot wind from 270° at 25, 000 feet. (In this problem the wind has been disregarded on return leg.) The temperature at 25, 000 feet is -44. 5°C.
3. The home field conditions are: elevation 500 feet, altimeter setting 29. 75 and temperature 27°C, wind southwest at 20 knots, runway 18 which is 8, 000 feet long is the active runway. RCR = 12 (surface wet).
4. Aircraft loading will include:

Armament	Weight (Fig. A1-7)	Drag Index (Fig. A1-7)
(2) M117	1646 lb.	128
(2) CBU-14/A	500 lb.	50
(2) LAU-59/A Rocket launchers	350 lb.	26
Nose Gun Ammunition	78 lb.	0
Total	2574 lb.	204

Fuel		
Fuel Internal	1804	0
Tip Tanks	1170	0
(2) Pylon Tanks (Includes tank weight)	1503	64
Total	4477	64

Gross weight will be 13,665 pounds, including 2 pilots at 200 pounds each. Drag index fully loaded will be 204 + 64 = 268. The pylon tanks weigh 119 pounds each when empty.

PLANNING THE MISSION:

The first step is to fill out the Takeoff and Landing Data Card contained in T. O. 1A-37B-1CL-1.

Conditions:

a. Gross weight (full fuel and crew of two) =	13,665 lb.
b. Runway air temperature (weather data) =	27°C
c. Field pressure altitude =	670 ft.
d. Effective wind	
Headwind component (fig. A2-1) =	14 Kts.
Crosswind component (fig. A2-1) =	14 Kts.
e. Runway slope =	0%

It must also be noted from figure A2-1 that the minimum nose wheel lift-off and touchdown speed = 78 KIAS.

f. Runway condition reading RCR (wet) =	12
g. Runway Length =	8,000 ft.

Takeoff Data:

a. Takeoff factor (fig. A2-3) =	2.5
b. Critical field length (fig. A2-6) =	6250 ft.
c. Takeoff run (fig. A2-4 full flaps) =	2200 ft.
d. Takeoff speed (fig. A2-2 full flaps) =	128 KIAS
e. Refusal speed (fig. A2-7 and A2-8) =	98 KIAS
f. One engine out best speed (fig. A3-1) =	175 KIAS

Landing Immediately After Takeoff:

a. Gross weight =	13,365 lb.
b. Touchdown speed (fig. A8-1) =	124 KIAS
c. Landing roll (fig A8-2) =	5700 ft.
d. Landing roll corrected for RCR (fig. A8-3) =	10,200 ft.

Landing Data:

In order to determine the landing gross weight, complete the airborne portion of the mission at this point and add landing data as the last step.

a. Gross weight =	7154 lb.
b. Touchdown speed (fig. A8-1) =	85 KIAS
c. Landing roll (fig. A8-2) =	1400 ft.
d. Landing roll corrected for RCR = 12 (fig A8-3) =	2500 ft.

A-37B TAKEOFF AND LANDING DATA CARD.

Conditions:	Takeoff	Landing
a. Runway air temperature =	27°C	27°C
b. Field pressure altitude =	670 ft.	670 ft.
c. Wind (Dir. and Vel.) =	225/20	225/20
d. Runway condition reading RCR =	12	12
e. Runway heading and length =	18-8000	18-8000

Takeoff:

a. Gross weight =	13,665 lb.
b. Takeoff run =	2200 ft.
c. Takeoff speed =	128 KIAS
d. Refusal speed =	98 KIAS
e. Best climb (one engine) =	175 KCAS

Landing:

	Immediately After Takeoff	Final Landing
a. Gross weight =	13,365 lb.	7154 lb.
b. Touchdown speed =	124 KIAS	85 KIAS
c. Landing roll =	8425 ft.	2500 ft.

It is assumed that the initial wind conditions still prevail and it can be seen from figure A2-1 the minimum touchdown speed cannot be less than 78 KIAS.

The airborne portion of the mission is planned as follows:

Outbound Leg:

The outbound leg consists of a climb from field elevation to cruise altitude and then cruise at speeds for 99% maximum range to the target. Drop wing pylon tanks when empty.

a. Climb from 500 to 25,000 feet.
   1. Gross weight at start of climb (allow 300 pounds for ground operation and takeoff)(engine start gross weight - ground allowance) = 13,665 - 300 = 13,365 lb.
   2. Fuel used (fig. A3-2) = 585 lb.
   3. Time required (fig. A3-3) = 8 min.
   4. Horizontal distance covered (fig. A3-3) = 35 N. mi.

b. Drop empty pylon tank (DI = 231).

c. Cruise at 25,000 ft. (first segment).
   1. Initial cruise gross weight = 13,365 - 585 - 119 = 12,661 lb.
   2. Fuel remaining in second pylon tank = 1265 - 300 - 585 = 380 lb.
   3. Average gross weight = $12{,}661 - \frac{380}{2} =$ 12,471 lb.
   4. True airspeed (figure A4-2) = 282 KTAS
   5. Time (figure A4-3) = 12.8 min.
   6. Ground speed (figure A4-2) = 257 knots
   7. Ground distance (figure A4-2) = 55 N. mi.

d. Drop empty pylon tank (DI = 194).

e. Cruise at 25,000 ft. (second segment).
   1. Initial gross weight = 12,661 - 380 - 119 = 12,162 lb.
   2. Remaining cruise distance to target = 180 - 35 - 55 = 90 N. mi.
   3. Estimated fuel required = 620 lb.
   4. Estimated average gross weight = $12{,}162 - \frac{620}{2} =$ 11,852 lb.
   5. True airspeed (figure A4-2) = 283 KTAS
   6. Ground speed (figure A4-2) = 258 knots
   7. Time (figure A4-2) = 21 min.
   8. Fuel used (figure A4-3) = 603 lb.

Fuel used agrees closely with estimated fuel required, so the problem is not reworked.

On Target:
Activity in the target area includes a 30 minute loiter at 25,000 feet on two engines, a descent to sea level for which no distance or fuel credit is given, and ten minutes of combat at which time the stores are released and the ammunition is discharged.

a. Loiter on two engines at 25,000 feet at maximum endurance speed.
   1. Initial loiter gross weight = 12,162 - 603 = 11,559 lb.
   2. Loiter fuel based on initial gross weight (figure A5-2, sheet 1 of 2) = 700 lb.
   3. Average loiter gross weight = $11,559 - \frac{700}{2}$ = 11,209 lb.
   4. Loiter fuel based on average gross weight = 680 lb.
   5. Time = 30 min.
   6. Speed (figure A5-1, sheet 1 of 2) = 201 KTAS
b. Descend to sea level, no distance or fuel credit.
c. Combat at sea level.
   1. Time 5 min.
   2. Fuel used (figure A6-1, fuel is independent of gross weight and drag index) = 240 lb.
   3. Release stores and discharge ammunition = 2574 lb.
   4. DI = 0 for return leg

Return Leg:
The return leg consists of a climb on course to cruise altitude, shut down one engine and cruise at maximum range speed, then descend to field elevation.

a. Climb to 25,000 feet on two engines at maximum RPM.
   1. Start climb gross weight = 11,559 - 680 - 240 - 2574 = 8065 lb.
   2. Fuel used (figure A3-2, sheet 1 of 3) = 260 lb.
   3. Time (figure A3-3, sheet 1 of 3) = 3.5 min.
   4. Distance traveled (figure A3-3, sheet 1 of 3) = 15 N. mi.
b. Cruise at 25,000 feet on one engine.
   1. Initial cruise gross weight = 8065 - 260 = 7805 lb.
   2. Distance (descent distance must first be found) (mission radius - climb distance - descent distance) = 180 - 15 - 45 = 120 N. mi.
   3. Fuel required based on initial cruise gross weight (figure A4-9)
      a). Specific range = 0.250 N. mi/lb. fuel
      b). Fuel used = 120/.250 = 480 lb.
   4. Average cruise gross weight = $7805 - \frac{480}{2}$ 7565 lb.
   5. Fuel required based on average cruise gross weight (figure A4-9)
      a). Mach (sheet 1) 0.363
      b). Specific range (sheet 3) 0.255 N. mi/lb. fuel
      c). Speed (sheet 4) 215 KTAS
      d). Fuel used = 120/.255 = 470 lb.
      e). Time = 33.5 min.
c. Descend to field elevation, 500 ft.
   1. Initial gross weight = 7805 - 470 = 7335 lb.
   2. Time (figure 7-1) = 11.5 min.
   3. Distance (figure 7-1) = 45 N. mi.
   4. Fuel used (figure 7-1) = 181 lb.
   5. Final gross weight = 7335 - 181 = 7154 lb.

At Destination

a. Time elapsed = 2 hrs. 8.4 min.
   1. Outbound leg (climb + cruise on pylon tank + cruise to target) = 8.0 +12.8, +21.1 = 41.9 min.
   2. On target (loiter + combat) = 30 +5 = 35.0 min.
   3. Return leg (climb + cruise + descent) = 3.5 + 33.5 + 11.5 = 48.5 min.
b. Total fuel used = 3699 lb.
   1. Outbound leg (ground operation + climb + cruise on pylon tank + cruise to target) = 300 + 585 + 380 + 603 = 1868 lb.
   2. On target (loiter + combat) = 680 + 240 = 920 lb.
   3. Return leg (climb + cruise + descent) = 260 +470, +181 = 911 lb.
c. Fuel reserve (initial fuel - fuel used) = 4239 - 3699 = 540 lb.
d. Final gross weight = 7154 lb.

The landing data for 7154 pounds may now be entered on the Takeoff and Landing Data Card.

SUMMARY.

Check your flight plan during the actual flight to determine whatever deviations exist. These deviations may be applied to the reserve expected at the destination. The most important factors to consider are:

a. Fuel used during start, taxi and takeoff.
b. Deviation from recommended climb schedule.
c. Deviation from recommended cruise control.
d. Variation in engine performance.
e. Navigational errors.

INDEX

ALPHABETICAL

Numbers in Parentheses ( ) are Illustration Figure Numbers

Numbers in Parentheses ( ) are Illustration Figure Numbers

Numbers in Parentheses ( ) Are Illustration Figure Numbers

Numbers in Parentheses ( ) Are Illustration Figure Numbers

Numbers in Parentheses ( ) are Illustration Figure Numbers

Numbers in Parentheses ( ) are Illustration Figure Numbers

Numbers in Parentheses ( ) are Illustration Figure Numbers

Numbers in Parentheses ( ) are illustration Figure Numbers

☆ U.S. GOVERNMENT PRINTING OFFICE: 1971 — 769-136/1940